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NBS Special Publication 500-72

Guidance on Requirements Analysis for Office Automation Systems

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Guidance on Requirements Analysis for Office Automation Systems

U.S. DEPARTMENT OF COMMERCE
Philip M. Klutznick, Secretary

Jordan J. Baruch, Assistant Secretary for Productivity, Technology and Innovation

National Bureau of Standards
Ernest Ambler, Director

Issued December 1980

Reports on Computer Science and Technology

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Foreword By the National Bureau of Standards

Protocol, interface and formatting standards are being produced by the National Bureau of Standards (NBS) for global, national and international networks, for local area data networks, and to support computer based office systems applications. Guidelines on the use and selection of supporting technologies are also being produced by this NBS networking program. The objective of this program is to facilitate the interconnection and integration of computer systems and devices through networking technology to support distributed processing.

This report is one of a series of reports being prepared under the computer based office systems segment of the networking program for distribution to Government agencies, manufacturers, and other interested parties. This report is being issued in the NBS Special Publication series prior to its final issuance as a guideline in the Federal Information Processing Standards (FIPS) series. We encourage testing of the methodology described herein and we urge readers to provide comments and to further interact with us on this report. Written comments should address both the advantages and disadvantages (from the reader's viewpoint) of individual features described in this report. Responses should be directed to the address below, and NOT to the NBS contractor that prepared the report.

Reply to:

National Bureau of Standards (Code CBOS)
Systems and Network Architecture Division
Technology Building, Room B218
Washington, DC 20234

* Contained within this report are sample questionnaires used to obtain research data for this report.

Office automation systems can be broadly defined as those that transform ideas into written communications via the interaction of people, procedures, and equipment. In recent years, numerous studies, reports, and articles have proposed that the use of such systems will contribute to the efficient preparation and distribution of general office communications and work products. However, the Federal experience with office automation has been primarily limited, thus far, to the implementation of word processing equipment and documented evidence of the benefits received from these installations have not been produced.

This guideline presents a methodology for determining the feasibility and practicality of introducing (or expanding) office automation systems within the Federal Government. It is applicable to all office automation technologies such as word processors, dictation equipment, and telecommunications and is designed for use by agency officials and other employees who have the responsibility for productivity improvement, procedural analysis data processing, or office systems.

Key words: Computer based office systems; office automation; requirements analysis.

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EXECUTIVE SUMMARY

In recent years, organizations have been turning towards the use of automated equipment to effect productivity improvements in the office environment. The Federal experience with such equipment, however, has often been characterized by an inability to produce documented evidence of the actual benefits received from these procurements. With the ever increasing investment of agency funds for new and different types of office automation equipment, the need for thorough requirements analyses and procurement justifications has reached new importance. This guideline has been developed to assist agencies in fulfilling that need. It provides a detailed study methodology for determining the feasibility and practicality of implementing office automation systems as well as a means for evaluating implementation results.

The guideline is applicable to all types of office automation technologies such as word processors, dictation equipment, and telecommunications. It is designed for voluntary use by agency managers and other employees who have responsibility for productivity improvement, procedural analysis, data processing, or office systems.

Previous studies aimed towards analyses of office automation need and justification primarily focused on the singular use of word processing to directly aid the clerical and secretarial staffs. When viewed in perspective, though, it becomes evident that in many cases the major benefits of office automation will be realized only when additional steps are taken to directly provide automated tools to the professional staff. Thus, studies of office automation must go beyond word processing and the traditional emphasis on clerical support. They must, in fact, concern themselves with the impact of a wide range of professional oriented technologies (e.g. personal information retrieval, speech mail, videoconferencing) that can affect all areas of office work from the input of ideas through the distribution of communications. Additionally, they must recognize the need to consider organizational and procedural factors as collateral means for increasing staff productivity.

This guideline addresses these issues by employing a method of analysis that reveals productivity data relating directly to the workload of both the professional and support staffs. The output of this work is defined and used as the basis for identifying productivity improvement opportunities. This result is achieved by collecting cost and time data that are allocated to the preparation of an organization's products.

A "product" is defined as a unit of regularly produced output, either in written form or as a service contributed to by one or more individuals and requiring significant amounts of time and cost. Because an organization's products tend to evolve slowly over time and represent a common language to employees, it is advantageous for products to become the focus of the study effort. By examining data on a product basis, it becomes feasible to identify a set of organizational, procedural, and technological productivity improvements, and note the quantitative effect of these improvements on product preparation efforts.

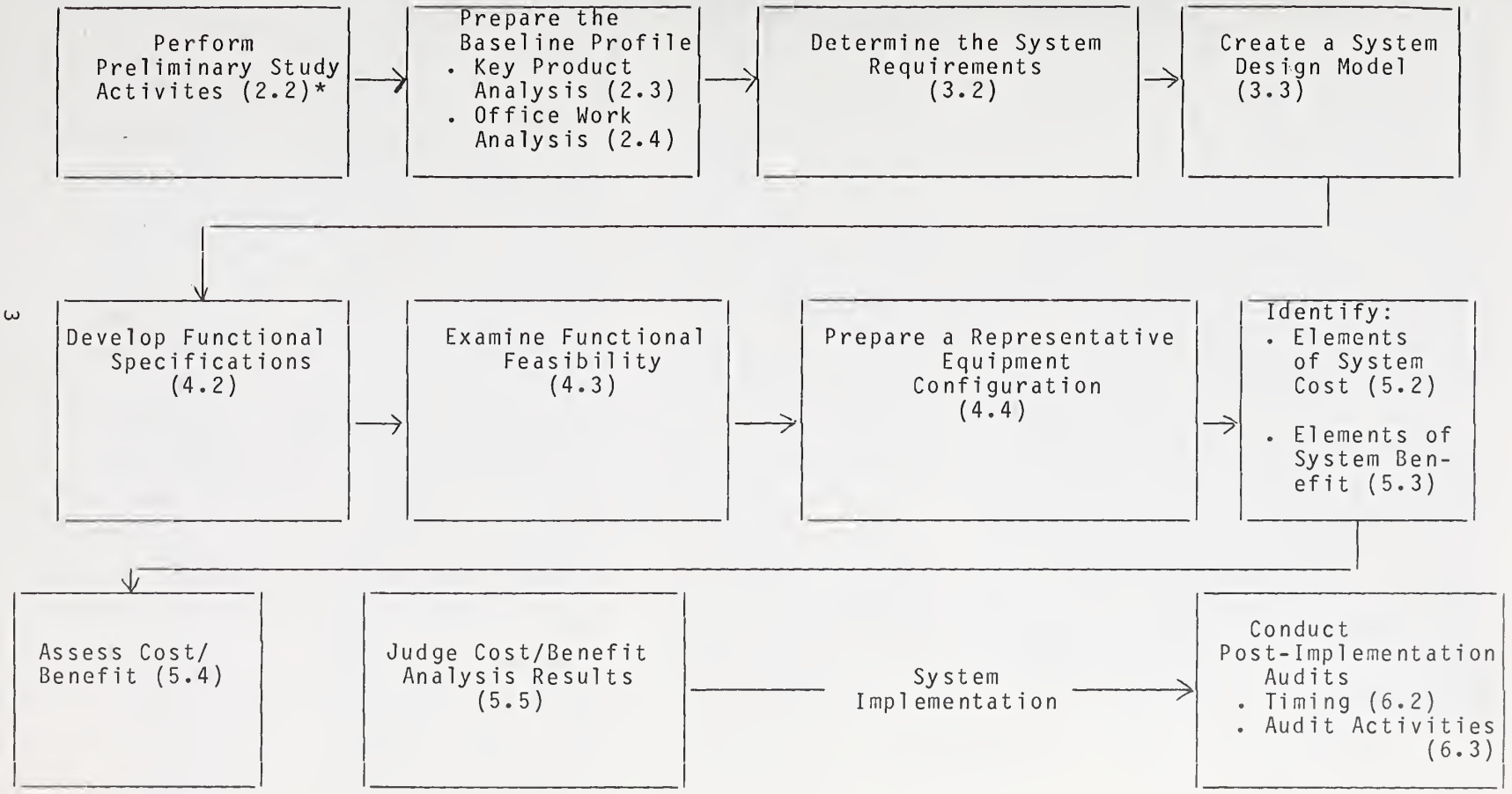
In its broadest sense, the study methodology presented herein entails the collection of data from professional and support staffs through interviews, questionnaires and observations. Exhibit 1, graphically illustrates this methodology and references the appropriate section of the guideline for further discussion. An overview of the major points contained in each chapter is presented below:

- Determining Baseline Office Productivity -- A study team is created and examines the existing efforts and costs required for key product preparation through the generic phases of input, production, output, and distribution. Simultaneous to this effort, an office work analysis is performed focusing on the total range of daily activities performed by office personnel. The data from both collection efforts are analyzed and used to create a "baseline" profile of existing office productivity.

- Designing the Office Automation System -- Using the baseline results, the study team develops system requirements to achieve a set of productivity improvement goals. These requirements become the basis for developing a macro level "system design model" that incorporates organizational, procedural, and technological modifications to improve baseline key product preparation efforts. The expected productivity improvement impacts of each modification are then quantified.

- Developing Functional Specifications for the Office Automation System -- The study team further defines the technological components of the system design model by preparing functional specifications for each equipment type identified therein. Once these specifications are prepared, a representative equipment configuration is constructed including its estimated cost.

Exhibit 1 - The Study Methodology



*Section of the guideline to be referenced

- Assessing the Cost Justification for the Office Automation System -- The study team prepares cost projections to reflect two conditions: retaining the baseline system and implementing the office automation system. A separate projection is prepared for each alternative that was specified. These projections are compared to ascertain whether or not it is practical and justifiable to proceed with full or partial system implementation.

- Conducting Post-Implementation Audits of the Office Automation System -- The purpose of these audits is to compare expected vs. actual productivity improvements achieved. To perform the audit, the study team replicates the key product and office work analyses performed during the original baseline study. The audit results indicate the degree of productivity improvement achieved and identify potential areas of further enhancements.

Each chapter of the guideline should be thoroughly reviewed before embarking on any activity described herein. Due to practical considerations of time and cost, agency managers may find it advisable to limit the scope of the study to either a few pre-determined key products, a small section within the total organization, and/or to specific phases of the product preparation process. In no case however, should any of the major activities described in the methodology be eliminated. The scoping decision is of critical importance and should be related to either the estimated size of the office automation procurement budget or to the realistic availability of staff resources to perform the study.

There are two other cautions that must be recognized by agency managers pertaining to the use of this guideline. First, organizations should approach office automation in a cautious, organized manner, understanding that not all areas of the office are susceptible to automated improvements. Second, management must recognize that the value of office automation improvements will be realized only if the newly available time of professional and support staffs are directed towards new or additional activities designed to improve organizational effectiveness. This is the challenge to organizations that are deciding to introduce office automation or any other types of productivity improvement measures.

1. OFFICE AUTOMATION AND THE FEDERAL GOVERNMENT

The large majority of the Federal work force is comprised of "white-collar" workers in offices. In contrast to farm and industrial workers whose productivity has grown due to automation, the productivity of office workers has remained flat. This has frequently been attributed to an undercapitalization of office workers relative to these other types of workers, and the application of a variety of computer and communications technologies has been suggested to automate office functions. In recent years, numerous studies, reports, and articles have agreed that the use of such systems will contribute to the efficient preparation and distribution of general office communications and work products. However, the Federal experience with office automation has been primarily limited, thus far, to the implementation of word processing equipment and documented evidence of the benefits received from these installations has apparently yet to be produced. A 1979 GAO Report (FGMSD-79-17, April 6, 1979) stated that:

> "... most agencies can neither demonstrate that they have increased their productivity nor that their word processing systems are, in fact, cost effective."

The report concludes that this resulted because there is no major commitment to conduct thorough feasibility studies, cost justification analyses, and post-implementation performance audits. While this GAO report dealt only with word processing, it can be implied that a similar condition exists with other office automation technologies.

Good management practices dictate that an organization conduct extensive advance planning prior to the introduction of office automation equipment. Although there are few existing Federal regulations that apply to office automation equipment procurement, a 1977 GSA regulation (FPMR-101-11.9, Amendment B-36, August 1977) requires agencies to perform feasibility studies with cost justification analyses and to audit the results of the installation. To aid in compliance with this regulation, the National Archives and Records Service (NARS) recently prepared a handbook entitled "Methods and Procedures for Conducting Word Processing Feasibility Studies" which, though limited in scope to word processing, is a first attempt at providing guidance to Federal agencies.

The purpose of this guideline is to present a methodology for determining the feasibility and practicality of introducing (or expanding) office automation systems within Federal agencies. It is designed for use by agency managers who have the responsiblity for productivity improvement, procedural analysis, data processing, or office systems.

1.1 Technologies and Benefits

Computer-based office information systems are built around three principal technologies:

- Data Processing, including storage and retrieval
- Document Production, including input, editing and output
- Communications, among and between both humans and machines.

Depending on the tasks to be accomplished within the particular office to be served, office automation systems may contain different mixes of these three classes of technology.

The object of an office automation system is to improve the productivity of the office it serves. In general, productivity is a ratio of output to input; productivity is improved whenever the ratio increases. In offices, productivity is measured relative to labor expended; productivity improves whenever the quantity or quality of office products increases relative to the labor applied.

There is generally some expense involved in improving productivity. While some procedural or organizational changes may be relatively inexpensive to implement, a typical office automation system represents a significant expense to an agency. This expense is justified if the value of the productivity increase exceeds the cost to achieve it (including the cost of designing, installing and operating the system). The value of a productivity improvement may be in any of the following terms:

- Cost savings through a reduction in labor time or rates in the areas concerned
- Cost avoidance through an ability to handle an increased workload with less than proportionate labor increase
- Improved performance of agency mission through improved quality of office products or services.

1.2 Justifying Office Automation

In order for an agency to justify a proposed office automation system, it must:

- Gain a sufficient understanding of the work performed in the office to know where productivity improvements can be achieved

- Develop specifications for one or more office automation systems that can yield an expected, measurable improvement in productivity

- Demonstrate that the value of the productivity improvements exceed the costs of the proposed system by a sufficient margin.

The guidelines in this document address each of these problems. First, a methodology is suggested that can enable an agency to gather information about the work that is performed in its offices in such a way as to reveal the unit costs of individual activities. This permits attention to be focused on those areas that consume the greatest amount of labor input and thus are presumably the most susceptible to productivity improvement. The methodology focuses on the "products" or outputs of the agency, which may be written results or services performed. The labor contributions of both professionals and clericals at all stages of production for each product or service are measured. The following general stages of product preparation are considered:

- Input
- Production
- Output
- Distribution

Actually, each product or service is traced though all the steps necessary for its completion, with applied labor tabulated for each step. In addition, staff time that does not contribute directly to agency outputs is tabulated separately.

Once the nature and costs of agency office work is known, systems can be designed to improve productivity in those areas where opportunities are seen to exist. Different office technologies are applicable to different stages of production. By tabulating labor consumption separately for each stage, the appropriate technologies to be considered in detail are suggested. Based on the data collected and estimated productivity improvement factors for each technology, one or more "design models" are constructed. A design model is a block diagram or conceptual approach to a new system that illustrates the components of the system without all the detail necessary for actual procurement of components or actual implementation. The design model is, however, described in sufficient detail to permit the benefits from the proposer system to be determined.

Based on the design model(s), detailed functional specifications are then prepared for the proposed systems. These specifications are sufficiently detailed to permit a reasonable estimate to be made of the cost of each proposed system, through reference to price lists of currently available components. Once both benefits and costs are determined for each alternative, a cost/benefit analysis can be performed.

The cost/benefit analysis consists of comparing all the costs and all the benefits for the current system and each design model over some appropriate time period (typically the expected lifetime for a design model). The net benefit for an alternative is the difference between total benefits and total costs (expressed in current dollars). All systems for which the net benefit is positive can be considered feasible or "justified."

There are certain complications to be considered in performing such an analysis. Costs are generally straightforward to identify and tabulate, but care must be taken that all costs are included. Identifying and quantifying all benefits is more difficult. Changes in labor inputs, either through labor reduction or substitution by lower cost labor, can be estimated based on productivity factors typical of each equipment type. Qualitative improvements in the products or services of the agency must however, be quantified subjectively. Such improvements are real and significant, but adequate justification must be provided when they are valued. Such quantification is difficult, thus it is often easier to use qualitative factors as a means of ranking alternatives after the alternatives have been justified through "hard" savings.

Subsequent chapters of this Guideline deal with determining the current level of office productivity, constructing a design model, and preparing a cost justification. One additional chapter deals with post implementation audits. This is an important aspect to office systems projects, since data are not abundant on the levels of success realized through different approaches and technologies. By collecting data again after implementation in the same format as was collected originally, a valuable data base can be compiled that will assist in future projects and justifications. Such audits can be conducted specifically of the office automation project, or as a part of regular reviews of agency operations.

This Guideline, then, addresses all the key steps that an agency must take in order to justify an automated system to improve the productivity of its office operations. The general methodology recommended (the "product" approach) is an analytical tool designed to facilitate the preparation of such justifications. There are several data collection methodologies (direct observation, structured recall, controlled-interval self-observation) that can be appropriately selected and used to provide the necessary data concerning the current system. The scarcity of data on productivity factors associated with different technologies will only be remedied as more systems are implemented and carefully audited. For the present, reliable data is really only available for the word processing and data processing components of office systems. For this reason, the examples cited focus heavily on these areas, though the methodology is applicable to all types of office technology.

What distinguishes this methodology from the traditional word processing study techniques is its emphasis on professional productivity improvement. Because professional staff generally earn significantly higher salaries than do support staff, it is evident that the major benefits of office automation will be realized only when professional productivity is improved. This can be accomplished partially by improving support staff productivity, since many non-professional functions performed by professionals can be shifted to the support staff. However, full realization of the opportunities from office automation requires improvement in the productivity of professional tasks as well.

As just indicated, these Guidelines are intended to address the determination of requirements for the full range of office automation equipment, including word processing, data base management, information storage and retrieval, telecommunications and data processing. These technolgies can be analyzed individually with the recommended methodology, or preferably, an integrated approach can be taken. Due to practical considerations of time and cost, agency managers may find it advisable to limit the scope of the study. Guidance on how to perform this scoping effort is provided in Chapter 2. In no case, however, should any of the major activities described in the methodology be eliminated. Finally, the use of this Guideline cannot ensure the identified productivity benefits will be achieved nor guarantee that the opportunity for improvement will, in fact, be exploited. This task requires management commitment to ongoing measurements of work performed by the organization.

2. DETERMINING BASELINE OFFICE PRODUCTIVITY

2.1. Introduction

Productivity can be defined as an efficiency ratio of input resources to output results. Productivity can be improved by:

- reducing input resources without reducing output results
- increasing output results without increasing input resources
- increasing output results by proportionately more than an increase in input resources
- decreasing output results by proportionately less than a decrease in input resources

In all four possible cases, the current level of productivity in the organization is the standard or "baseline" against which changes are measured. Thus, the baseline must be measured before the feasibility of any proposed changes can be analyzed.

The study methodology presented herein is characterized by a set of procedures for collecting and analyzing office productivity data. To aid in the measurement of productivity improvements, similar procedures are followed during an initial feasibility study of existing (i.e., baseline) office productivity and subsequent audits of the automated office. These procedures are applicable regardless of the size of the organization under study. If, however, the study is being performed for a newly established office or one that is significantly expanding its responsibilities, baseline productivity may have to be estimated through comparisons with similar size organizations performing similar type work.

Baseline office productivity data are collected in two formats, with each format targeted on both professional and support activities. The first and primary format is "product" oriented and the second involves a general office work analysis.

A "product" is defined as a regularly produced output, either in written form or as a service, contributed to by one or more individuals and requiring significant amounts of time and cost. For example, preparation of budget justifications normally involves input from numerous individuals with different responsibilities ranging from actual preparation to final review. Each individual may not be continuously

involved in the preparation of this product, but his or her contribution towards its completion must be tabulated. The two advantages of relying upon products as the primary units of analysis are that they tend to evolve slowly within an organization from year to year and they represent a common language to all.

Product oriented data are obtained through a study of the existing preparation efforts and procedures of both the professional and support staffs. From these data, measures of baseline productivity are derived and used in designing an office automation system which includes procedural and/or organizational modifications to effect productivity improvements.

Employees may also be engaged in office work that does not contribute directly to products -- training is one such example, waiting for work is another. It is important to gain some understanding of the distribution of this non-product oriented work as well as the product oriented work. Not all of the non-product oriented work (such as training) can be addressed through office automation, but some of it (such as waiting for work) can be. General office work activity data also serves to validate and refine key product data.

To obtain these baseline data, an office work analysis is conducted to identify daily activities performed by both the professional and support staffs. These activities are than assessed in terms of level of effort (i.e., staff time) and cost to the organization. The data can be collected through direct observation or through a recently developed technique of controlled interval self-observation.

The resulting baseline office productivity profile, developed from both the key product and office work analyses, serves three purposes. First, it serves as the basis for designing automated enhancements and procedural modifications to the existing processes and in identifying organizational changes of potential benefit. Secondly, it is used when assessing the cost justification of the office automation system. Thirdly, it is used in examining the post-implementation audit results.

The remainder of this chapter presents and discusses the three primary activities which are required to determine baseline office productivity. These activities are:

- Preliminary Study Activities
- Key Product Analysis
- Office Work Analysis

2.2. Preliminary Study Activities

The preliminary study activities include study team structuring/planning, organizational notification of the study, initial office research, senior management interviews, and study tools development. These activities form the foundation for subsequent study efforts.

2.2.1. Study Team Structuring/Planning

Team member selection is of critical importance to the successful completion of the subsequent study activities. The team should ideally include members drawn from both the professional and support staffs within the organization to obtain a wide range of perspectives, and members who have previously demonstrated strong investigative, questioning, and analytical skills. In addition, team members should have functional experience within the organization since this implies an understanding of the organization's structure. They should also have previously demonstrated their ability to work in an organized manner toward a common objective. Finally, and most importantly, they should have some knowledge of various office automation technologies. If individuals possessing these attributes are not available within the organization to participate in the study effort, it is advisable to seek outside assistance from either other Federal organizations or from private contractors.

Organizational management selects the study team and informs the members of its purpose, their expected commitments, and the expected completion date for the study. A team manager is selected to serve as the daily coordinator of all study related activities.

There are numerous factors that should be considered when determining the size of the study team and the scope of the study effort. These factors include:

- Size of the proposed study area within the organization
- Skill level of proposed study team members
- Number of senior managers within the proposed study area
- Number of products within the proposed study area
- Number of key product contributors
- Total number of staff members within the proposed study area
- Complexity of products within the proposed study area

- Size of the budget likely to be available for office automation
- Number of different equipment types to be considered
- Number of alternate system designs to be considered
- Level of team knowledge concerning various office automation technologies.

Initially, information on many of these factors will be unknown; some will remain unknown until after the study has begun. Therefore, to initially structure the study team and estimate the required time, a small team may initially be established and a preliminary work plan and schedule prepared based upon the best estimates of the team manager. These estimates are then presented for approval to organizational management. If, after review, management decides that the time and costs required to perform the study are too great, a decision must be made to limit the scope of the study effort. The study scope can be limited to either a few predetermined key products, a small section within the total organization, and/or to specific product preparation phases (i.e. input, production, output, distribution). In no case, however, should any of the major study activities be eliminated. To aid management in the scoping decision, it is advisable that the extent of the study effort be related to either the estimated size of the office automation procurement budget or to the realistic availability of staff resources to perform the study.

Once the plan is approved and the study scope is determined, the study team is formally organized and each member reviews this guideline.

2.2.2. Organizational Notification of the Study

Following the structuring of the study team, organizational management next informs all employees within the study area of the nature, purpose, and importance of the study. This opportunity is used to convey management commitment to the success of the study efforts and to allay any anxieties. Ideally, a meeting is held to explain the purpose of the study and to introduce the team members. However, if this is impractical, a letter/memorandum to all office personnel within the study area is distributed. To help ensure a successful data collection effort, the staff must understand that their cooperation is required and expected. Additionally, the message must be conveyed that the study objective is to improve organizational productivity and make staff work easier.

2.2.3. Initial Office Research

After organizational notification is given, the study team conducts initial research activities to compile a preliminary list of study area products and gather other information in preparation for the subsequent activity of senior management interviews. Official documentation pertaining to the organization's functions is reviewed to assist in preparing the product list. Because this may be difficult in some organizations, Appendix A contains a "Typical List of Products" to help guide the study team in product identification. Organizational research is also performed to identify those senior managers who will be interviewed during the subsequent study activity. The criteria for interviewee selection includes individual management involvement in multiple products and an overall understanding of the existing efforts required for product preparation.

2.2.4. Senior Management Interviews

The purpose of the senior management interviews is to narrow the focus of the study effort to several key products (a subset of all identified products) that represent the performance of major office activities and would appear to benefit from the introduction of one or more types of office automation equipment. These key products will be subject to further examination during subsequent study activities.

A pre-interview memorandum which includes the preliminary list of products, developed during the initial office research, is distributed a few days prior to the interview to assist the manager in preparing for the discussion. The memorandum restates the study objectives, explains why the interviewee has been selected, provides interview objectives, defines any necessary terms, and describes specifically what is expected as a result of the interview. To assist the senior manager in narrowing the preliminary list of products, three criteria which relate to organizational importance and labor intensity are provided:

- Lengthy and intensive professional staff preparation due to the need to collect and reformat existing information
- High percentage of professional effort expended performing support-type functions
- High percentage of support effort to prepare products.

Interview teams should consist of two people to ensure that all issues are covered and all comments recorded. An interview guide will be developed to obtain the following data:

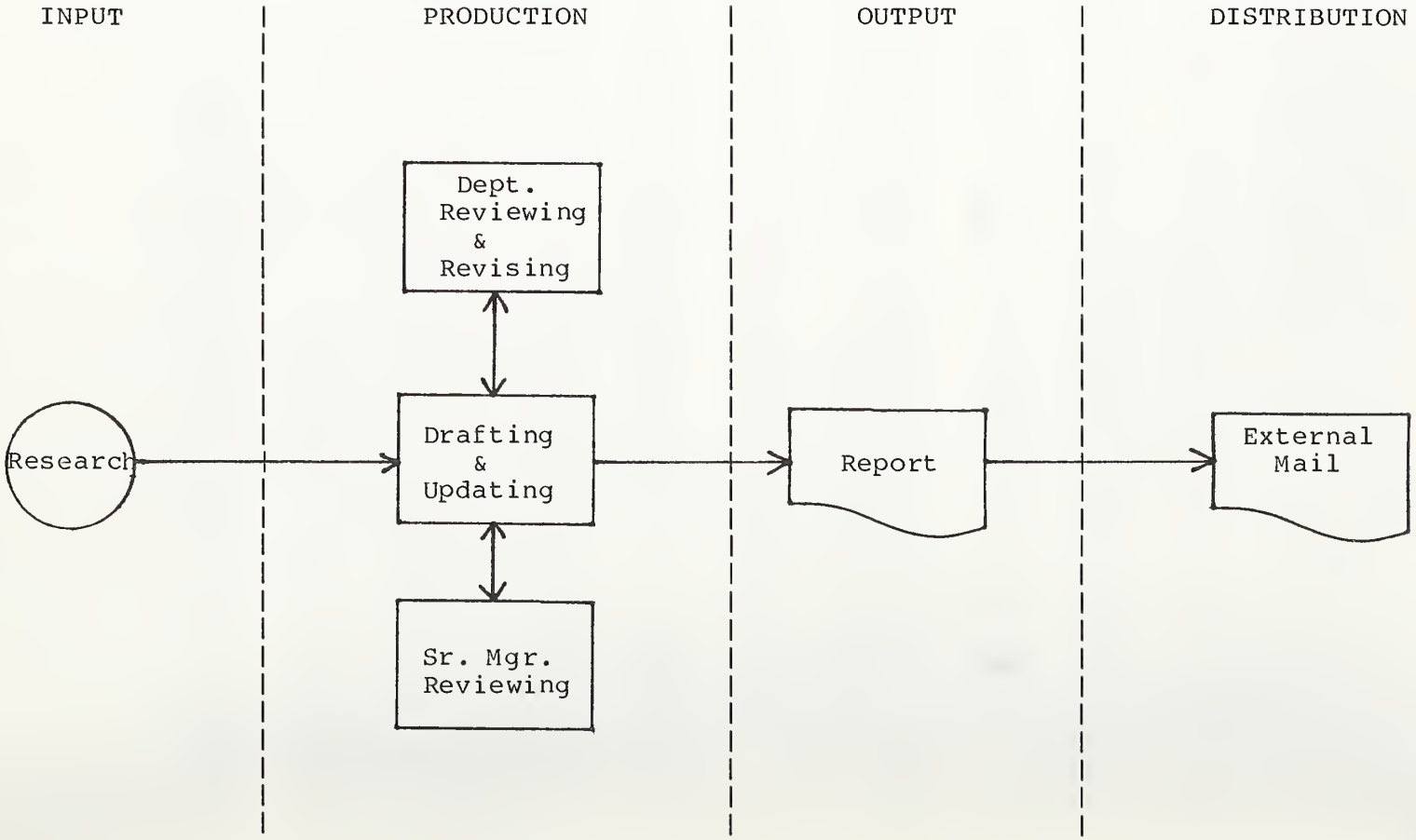
- General information on the product preparation activities, key product contributors, external interfaces to the preparation processes, and annual volume for each product the senior manager feels meets one or more of the stated criteria
- Recommendations for or against the automation of any specific product
- Judgments as to any specific areas or processes that may be prime candidates for automation
- Information regarding any prior experience with automation that would be of interest to the study team
- Those productivity factors for each product (i.e., timeliness, responsiveness, convenience, appearance) that appear to be relevant to the senior managers
- Information regarding changing workloads and projected organizational changes to be effected in the near future
- Suggestions and recommendations that will be beneficial to the study efforts.

After the senior management interviews are completed, the study team analyzes the results and recommends a group of key products for detailed examination. The key product recommendations are presented for approval to organizational management. A sample of each key product is secured and preliminary key product flow diagrams are prepared. These diagrams are segmented into the preparation phases of input, production, output, and distribution. (An example is presented in Exhibit 2.) Definitions of each phase are presented in Appendix E, "Technology Assessment".

2.2.5. Study Tools Development

Data collection tools for development and use by the study team in performing the detailed key product analysis include:

Exhibit 2 -- Preliminary Key Product Flow Diagram



- Source Identification Guide -- The purpose of this tool is to obtain structural information about the study area. Current information is requested on the names, titles, locations, and telephone numbers of key product contributors and their associated reporting relationships and position responsibilities. This information is used for reference purposes during subsequent study activities.

- Key Product Tracking Guide -- The purpose of this tool is to identify the detailed key product preparation activities from input to distribution. In addition to noting their own participation, key product contributors list, in chronological order, the names, offices, activities performed, and estimated levels of effort for all other key product contributors. This information is used to develop detailed baseline product flow diagrams and determine those activities subject to further investigation.

- Definitions of Terms -- The purpose of this tool is to provide the key product contributors with the definitions of data collection terms to be used by the study team during the interviews. A sample of this tool is presented in Appendix B.

- Key Product Interview Worksheet -- The purpose of this tool is to decompose the estimated level of effort (i.e., number of hours) for each key product activity into its component tasks and functions. A sample is presented in Appendix C. This information is used to develop aggregate levels of effort and cost regarding the preparation of key products.

- Key Product Interview Guide -- The purpose of this tool is to collect characteristic data on the tasks and functions identified in the Key Product Interview Worksheet. A sample is presented in Appendix C. This information will aid in the design of an office automation system.

The study team should review the information provided in Section 2.3 of this guideline before developing or modifying these tools so that each member understands their purpose, use, and necessity. As a result of this review, the team may modify the tools based on organizational considerations. However, if modifications occur, they should be approved by management before taking effect.

Data collection tools to be developed and used by the study team in performing the office work analysis include:

- Professional Daily Activity Log -- The purpose of this tool is to collect actual time/volume data on professional activities. This log lists the data items (tasks) included in the Key Product Interview Worksheet and any other major identifiable tasks. Respondents will note the hours they expend during the day in performing these tasks and the following associated data characteristics for each task:

  - Was the task accomplished by a totally manual process? (yes or no)

  - Was any equipment used in performing the task? If so, what type of equipment and how many hours was it used?

  - Was any travel necessary to perform the task? If so, how many hours?

  - Were any support-type functions performed by the professional to accomplish the task? If so, what type and how many hours?

  This information is used to develop aggregate levels of effort and costs regarding general office work activities.

- Definitions of Terms -- The purpose of this tool is to provide the professionals with definitions of data collection terms to be used in completing the Daily Activity Log. The sample Definitions of Terms is presented in Appendix B.

- Professional Questionnaire -- The purpose of this tool is to ascertain perceptions of work performance, support requirements, and the reactions to potential automation. A sample is presented in Appendix D.

- Support Daily Activity Log -- The purpose of this tool is to collect actual time/volume data on support activities. The log lists support data items (functions) as: taking dictation, transcribing, typing, photocopying/collating, filing, telephone coverage, sorting/delivering mail, preparing forms in longhand, posting information, using facsimile, composing letters, doing math calculations,

researching, maintaining the office, and any other major identifiable functions. Respondents will note the hours they expend during the day in performing these functions and the following associated data characteristics for each function:

- Was the function accomplished by a totally manual process? (yes or no)

- Was any equipment used in performing the function? If so, what type of equipment and how many hours was it used?

- How many pages (or units) were associated with the performance of the function?

This information is used to develop aggregate levels of effort and costs regarding general office work activities.

. Typing Summary -- The purpose of this tool is to obtain actual information on the format and daily volume of submitted materials. The following data characteristics are captured for each document typed: type of submission (new or revised), equipment used (typewriter or word processor), input form (longhand, shorthand, machine transcription, cut/pasted, computer printout, or previously typed), and format (original text, standardized text, statistics, forms fill-ins, graphics, or other). A copy of each document typed is attached to this tool.

. Support Questionnaire -- The purpose of this tool is to identify perceptions of work performance, support requirements, and reaction to potential automation. A sample is presented in Appendix D.

The study team should review the information provided in Section 2.4 of this guideline before developing or modifying these tools so that each member understands their purpose, use, and necessity. As a result of this review, the team may modify the tools based on organizational considerations. If modifications occur, they should be approved by management before taking effect.

As the final preliminary study activity, the study team decides how to summarize the study results. If the study area is large or composed of many functional groups, the data should first be summarized by work group, department, or similar functional unit and then collected into an organizational summary. If the study area is small, an organizational summary only need be prepared.

After all preliminary study activities are completed, the study team is ready to begin the in-depth data collection effort. The activities associated with the key product and office work analyses are presented in the following sections. Several of these activities can be performed simultaneously, but no activities should be omitted.

2.3. Key Product Analysis

The key product analysis is a quantitative exercise designed to collect and analyze data regarding the levels of staff effort (number of hours) and costs required to prepare specific key products selected for detailed examination as a result of the Senior Managemenent interviews. The general approach is one of "structured recall" in which a survey instrument is completed by key product contributors. The instrument forces consistent reporting by participants on all the key products to which they contribute. Once the data have been collected and reviewed, opportunities for potential productivity improvement can be identified. These data consider the efforts of both professional and support staff.

During the key product analysis, product preparation effort is examined through the generic phases of input, production, output, and distribution. Level of effort data for all key products are collected from key product contributors and summarized by activity within each of these phases. Interviews should also be conducted with those individuals outside of the study area who have been identified as external interfaces to the preparation of key products. Key product preparation activities are composed of both tasks and functions where professional contributions are defined as tasks and support contributions are defined as functions. Interviews with contributing personnel provide the answers to the "what, where, how, and how much" questions for each key product.

Once the key product analysis is complete, the accumulated data allow the study team to determine the baseline productivity associated with key product preparation and the associated key product costs. In addition, the key product flow diagrams provide illustrations of the preparation phases and specific activities. These accumulated data are used later in determining the potential impact of a set of organizational, procedural, and technological modifications to improve key product preparation.

2.3.1. Pre-Interview Considerations

The prerequisite to this stage of the key product analysis is the completion of the senior management interviews. The results of these interviews provide guidance for the key

product analysis data collection effort by identifying key products for further study, providing preliminary key product flow diagrams, and the names and locations of key product contributors.

At this point, a pre-interview packet, containing the Source Identification Guide, Key Product Tracking Guide (one for each key product) and Preliminary Key Product Flow Diagrams, is distributed to each key product contributor. (Each tool was previously described in section 2.2.5.) Packets are dissimilar to the extent that they contain Preliminary Key Product Flow Diagrams (and accompanying Tracking Guides) for the key products to which the individual contributes. In addition to these tools, a transmittal memorandum is included restating the study objectives, why the key product contributors are involved, what is expected from them, and a list of their relevant key products. Key product contributors provide their best estimates regarding the existing level of effort required to prepare each key product. After reviewing these materials, the study team decides which key product preparation activities consume significant effort and thus require further investigation.

2.3.2. Interviews With Key Product Contributors

Interviews with key product contributors are conducted to further define the existing level of professional and support effort required to prepare each key product. Interview teams should consist of two people to ensure that all issues are discussed and all comments recorded. To guide the interview, the study team provides the key contributor with the Definitions of Terms and completes the Key Product Interview Worksheet and Key Product Interview Guide for each key product activity under consideration. Also during the interview, the annual key product volume previously estimated by the senior managers is confirmed or modified.

The "data package" resulting from each key product contributor interview consists of:

- Completed Source Identification Guide
- Completed Key Product Tracking Guides for each key product
- Completed Key Product Interview Worksheets for each activity of each key product
- Completed Key Product Interview Guides for each activity of each key product.

2.3.3. Uses Of Key Product Analysis Data

After completing the interviews, the study team must make a subjective decision as to whether an acceptable percent of response from key product contributors has been received. If not, further interviewing will be conducted. For example, one previous study ("Office Systems Studies, Rationale, Techniques and Value"; Guide 47 by Richard A. Lowenstein, IBM Corporation, White Plains, New York) found a 65% survey response to be adequate. This, however, should not be taken as a general guide for all studies. In establishing the acceptable level, the study team must consider the representativeness of the sample to the entire population.

The data packages are sorted by key product and detailed key product flow diagrams are prepared showing the activities within each phase (input-production-output-distribution) and associated levels of effort. (An example is presented in Exhibit 3 on the following page.)

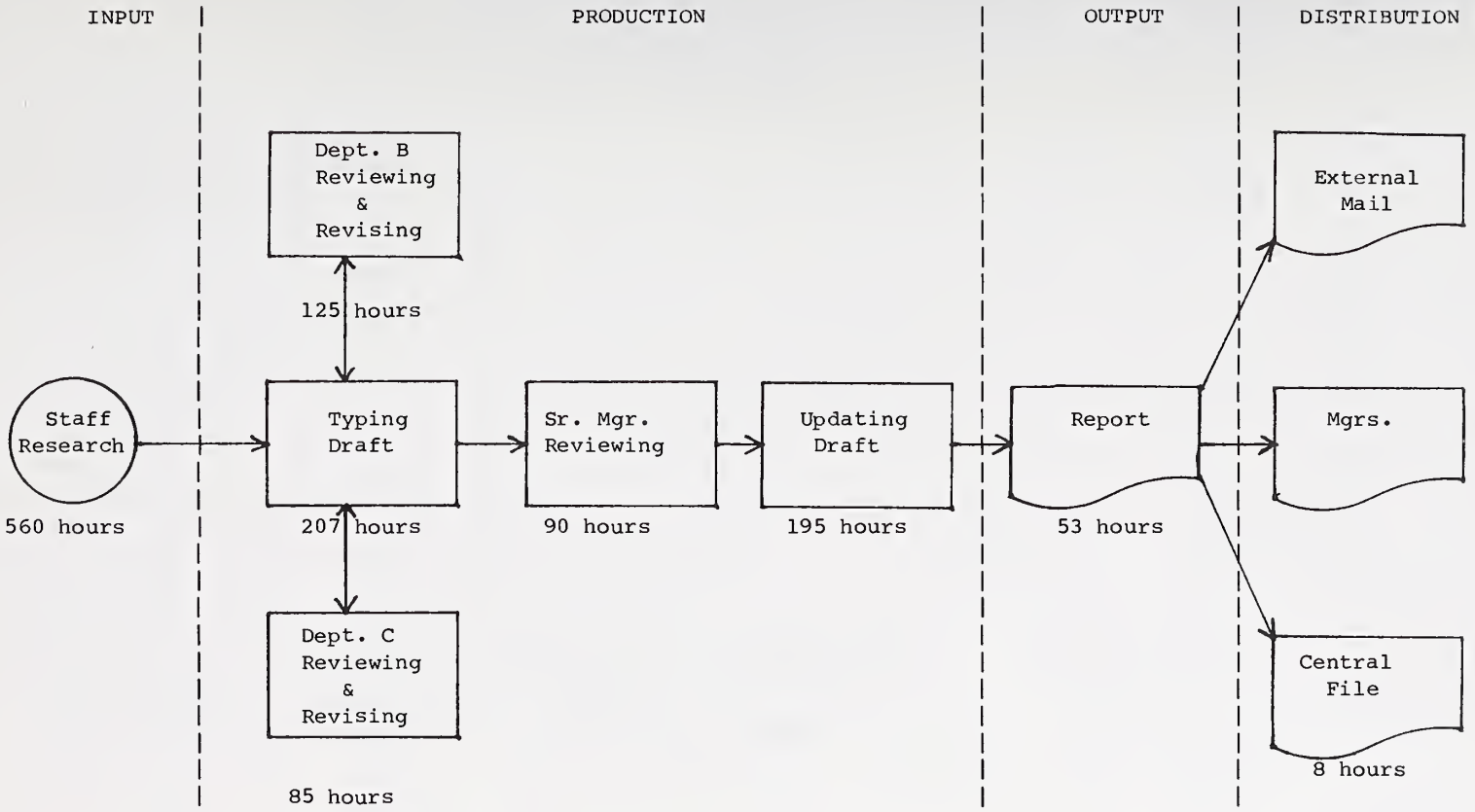
Level of effort data for each key product is next annualized by multiplying the key product contributor estimates by the annual volume. These data are summarized in a matrix to produce the following measures:

- Total key product preparation effort (professional and support staff)
- Total professional staff effort
- Professional effort expended performing professional work
- Professional effort expended performing support-type work
- Total support staff effort
- Professional Support Ratio (R_{ps}): professional staff effort performing support-type work expressed as a percentage of total professional staff effort
- Support Staff Ratio (R_s): support staff effort expressed as a percentage of total key product preparation effort.

(Exhibit 4 on page 24 presents an example of this matrix.)

Baseline preparation costs for key products are now constructed using the level of effort data. As a first step in determining these costs, annual average salaries for professional and support staffs engaged in key product preparation

Exhibit 3 -- Detailed Key Product Flow Diagram (Product 6)



Baseline Productivity:

- Total Hours Expended = 1,323 hours
- Total Professional Time = 860 hours
- Professional Time/Professional Work = 640 hours
- Professional Time/Support Work = 220 hours
- Total Support Effort = 463

Exhibit 4 -- Annual Levels of Effort To Prepare Key Products (Baseline)

KEY PRODUCTS	TOTAL PROFESSIONAL STAFF EFFORT HOURS*	PROFESSIONAL EFFORT PROFESSIONAL WORK HOURS*	PROFESSIONAL EFFORT SUPPORT-TYPE WORK HOURS*	R_{ps}	TOTAL SUPPORT STAFF EFFORT HOURS*	R_s	TOTAL KEY PRODUCT HOURS*
A	288.0	.0	288.0	1.0	.0	--	288.0
B	48.0	8.0	40.0	.83	1.0	.02	49.0
C	252.0	.0	252.0	1.0	.0	--	252.0
D	12.0	.0	12.0	1.0	.0	--	12.0
E	42.0	6.0	36.0	.86	.0	--	42.0
F	164.5	32.1	132.4	.80	2.0	.012	166.5
G	860.0	640.0	220.0	.26	463.0	.35	1323.0
TOTALS	1,666.5	686.1	980.4		466.0		2,132.5

* A person year is defined as 2080 hours in this sample.

are determined. In addition, a fixed percentage to provide for overhead and fringe is determined and added to these salary figures. Each total is divided by the annual paid working hours to obtain the hourly professional and support staff rates. For each key product (as well as phase and activity within each key product), the level of effort is multiplied by the hourly rates to determine estimated total direct key product preparation costs. (Exhibit 5 on the following page presents an example.)

Once all data collection is completed, the study team can concentrate on examining the results. An analysis of the key product matrices and key product flow diagrams permits the initial identification of potential areas of productivity improvement as evidenced by:

- Lengthy and intensive professional staff preparation time and cost due to the need to collect and reformat existing information
- High percentage of professional effort and cost expended performing support-type functions (R_{ps})
- High percentage of support effort and cost to prepare key products (R_s).

As a hypothetical example, consider the data provided in Exhibits 4 and 5. A review of these matrices indicates that key product G may be susceptible to productivity improvement because of the high cost and level of effort associated with its preparation. In this case, the study team would first reference the corresponding key product flow diagram (Exhibit 3) to identify each activity in the preparation process. For each activity, the team would next refer to the appropriate interview worksheets and guides (Appendix C) and examine the types of tasks and functions that are being performed. Using these data, the study team can determine the potential areas of productivity improvement for this key product.

When analyzing the key product data, the study team must be aware that there are limits to the usefulness and validity of the data that result from asking the respondent to:

- Go back too far in memory
- Provide answers about the efforts of others during key product preparation
- Attempt to separate work done on key products that are closely related and similar.

Exhibit 5 -- Annual Personnel Costs To Prepare Key Products (Baseline)

PERSONNEL COSTS / KEY PRODUCTS	TOTAL PROFESSIONAL STAFF COST	PROFESSIONAL COST/ PROFESSIONAL WORK	PROFESSIONAL COST/ SUPPORT-TYPE WORK	TOTAL SUPPORT STAFF COST	TOTAL KEY PRODUCT PERSONNEL COST
A	$ 4,026	$ -	$ 4,026	$ -	$ 4,026
B	671	112	559	9	680
C	3,523	-	3,523	-	3,523
D	168	-	168	-	168
E	587	84	503	-	587
F	2,300	449	1,851	18	2,318
G	29,500	14,500	15,000	14,100	43,600
TOTALS	$40,775	$15,145	$25,630	$14,127	$54,902

Although the handling of these cautions is based on subjective judgment, there are a few notes which should be considered by the study team. For example, if a problem with a particular key product arises because many contributors have exhibited difficulty in recall, that key product may be eliminated from the analysis. If a problem arises regarding answers received about the efforts of other persons during key product preparation, the study team should confirm those answers directly with the individuals. If key products seem to be closely related and similar, those key products may be combined into a "key product package" and reexamined.

Alternatively, the data collection efforts for the general office work analysis can be structured in such a way as to validate the structured recall data on product preparation. Through direct or controlled self-observation, work samples can be collected that describe a pattern of work activity. If a "typical" period is chosen to collect the data, then data about the same set of key products should be collected as a subset of the entire office work activity.

Finally, it should be emphasized that all of the data collected during the key product analysis are quantifiable and refer to the efficiency of preparing the output. While not required, the study team may also find it advantageous to examine data regarding the quality of the work being performed and the value of the key products to the organization. Work quality can be defined by such measures as timeliness, responsiveness, completeness, accuracy, appearance, and convenience. Information on these measures can be derived from the key product interview results and may be useful when identifying areas of potential productivity improvement. Assessing the value of the key products is a more difficult exercise. To adequately perform this effort, the study team will need to examine the specific programs or services associated with the key products and estimate the contribution of these products toward achieving the mission of the organization. If this can be accomplished, the team will be able to prioritize the key products in terms of their importance and correlate this information with the level of effort results. The nature of the proposed productivity improvements can then be better considered in light of the value of each key product.

2.4. Office Work Analysis

The office work analysis is performed simultaneously with the key product analysis and provides data on the total range of office activities, personnel skill levels,

and overhead costs. These data relate to background activities which are not directly related to key products. Results of this analysis provide detailed characteristics on general office work activities and an understanding of the overall working environment. These include statistics on how individuals work, their time expended on particular tasks and functions, the related costs and perceptions of the current office environment. These results also provide a means of comparison against those data obtained during the key product analysis.

2.4.1. Data Collection Activities

Data may be be collected for the office work analysis in a variety of ways. Direct observation by an outsider has been one of the established tools of industrial engineers since the days of Frederick Taylor, and can be applied in the office environment. It is, however, costly to apply for any significant sample, possibly disruptive of office operations, and likely to yield distorted results since people frequently work differently when they are under observation. An alternative is self-recording of time spent in different activities. This may be accomplished in a variety of ways, including self-recording in various types of activity logs. The difficulty with this approch is that it is so unstructured that workers frequently fail to record all activities. A recently developed technique that can be described as "controlled interval self-observation" provides another alternative that can be applied in situations where the collection of accurate office work data is important. In this approach, workers are provided with personal interval-timers and log booklets that they carry with them at all times during the sample period. The timer beeps or sounds an audible alarm at intervals to signal the worker to record his or her activity at that very instant. This approach eliminates the sampling bias that may be introduced when workers are asked to self-sample without such a regimen. The approach was developed and applied successfully by Booz, Allen and Hamilton in a recently completed multi-client study of office worker productivity in the private sector.

The data collection tools for the office work analysis are distributed to and completed by the professional and support staff sample within the study area. Where practical, the entire office staff may participate in the study. It is suggested that data be collected for ten working days regardless of organizational size. However, five days is an acceptable minimum. It is important that the data collection occur during a "typical" period (e.g., not during holiday seasons or end-of-year rush) so that the sample reflects normal operating conditions. Three previously

defined data collection tools (Section 2.2.5) are used. Daily Activity Logs accumulate actual time/volume data and assist in identifying general office work patterns. Typing Summaries provide information on the format and volume of submitted materials and Questionnaires yield information regarding perceptions of work performance, importance, support requirements, and reaction to potential automation.

The study team either conducts group meetings with the staff to explain the tools or uses a transmittal memorandum. In either case, they remain available to answer any questions on completing the data collection tools.

During this data collection period, the study team observes work activities within the study area to identify demands and bottlenecks in the routine working environment. They also perform an office inventory of current staffing, documented procedures (manuals), and existing automated equipment. Finally, the team collects data relating to the historic growth rate of the organizational workload and any planned future organizational changes. When compiled, these data provide a general picture of the baseline office environment.

Once the Daily Activity Logs, Typing Summaries, and Questionaires have been collected, the study team decides whether an acceptable percent of response has been received from the professional and support staff (refer to Section 2.3.3). If not, further data are collected. Individual Daily Activity Logs are now totaled to complete a weekly summary for each staff member and Typing Summaries are completed by computing and recording the line count for each individual document (copies of documents are attached to the summaries). Completed staff Questionnaires are reviewed in preparation for follow-up interviews with individuals from the study area.

2.4.2. Follow-up Interviews

The objective of the follow-up interviews is to verify and augment the collected data. In performing these interviews, a sample is drawn from the professional and support staffs. Organizational management should assist in determining the sample size and the prospective interviewees. Factors to be considered during the interviewee selection process include:

- Are the interview candidates also key product contributors? (It is best to include as many key product contributors as possible.)
- How long have the candidates been with the organization? (A mix of experienced and relatively new personnel is beneficial.)

- Is at least one member from each functional group within the study area included in the candidate interview sample?

During the follow-up interviews, the study team reviews with each respondent their completed Questionnaire to ensure accuracy and understanding in the transcribed data. Two study team members conduct each interview to ensure that all issues are discussed and all comments recorded. The interviewees responses pertaining to "how, why, or describe" questions provide descriptive detail and estimated time/volumes on professional and support work activities, the work environment, and perceptions of upward mobility and staff development within the organization.

2.4.3. Use of Office Work Analysis Data

After all data collection activities are completed, the results obtained from the Weekly Activity Summaries, Typing Summaries, and Questionnaires are summarized by the predetermined groupings, as discussed in Section 2.2.5, and totaled for the entire study area.

The summarized data are analyzed by the study team to produce baseline productivity measures as defined below. Productivity measures which should always be calculated include:

- Professional Support Ratio (R_{ps}): professional effort performing support-type work expressed as a percentage of total professional staff time.

- Support Staff Ration (R_s): support staff effort expressed as a percentage of total staff time.

Other representative measures which may be calculated include:

- Total hours and related cost for each professional task such as planning, consulting, etc.

- Total hours and related cost for professional effort performing support-type work

- Total hours and related cost for each support function such as typing, filing, etc.

Management should participate in determining those productivity measures which appear to be meaningful to the organization.

The study team then compares the office work analysis and key product analysis data. If significant differences are identified between these analyses, the reasons behind the variances must be determined. For example, do there appear

to be major discrepancies between the professional support ratios calculated during the key product and office work analyses? These discrepancies may exist because professionals may not have accurately estimated their time performing functional type work when questioned during the key product analysis interviews. After the issues are resolved, the study team completes the baseline office productivity profile and prepares a summary report on the findings from both the key product and the office work analyses.

2.5. Summary

This chapter of the guideline presented the methodology associated with determining the productivity profile for the baseline office environment. The following points should be considered during each stage of the effort:

- Preliminary Study Activities
  - Study team members are drawn from both the professional and support staffs. The selected individuals should exhibit certain capabilities. (Section 2.2.1)
  - Study team size is dependent on several factors, and should be appropriately sized for the task and resources of the organization (2.2.1)
  - Selection of senior management interviewees is based on managerial involvement in multiple products and his/her overall understanding of the existing efforts required for product preparation. (2.2.3)
  - As a result of the senior management interviews, certain prioritized products are labeled as "key products" for further analysis. (2.2.4)
  - The study team must decide how to summarize baseline results prior to conducting the detailed key product and office work analyses. (2.2.5)
- Key Product Analysis
  - After preliminary level of effort estimates are provided by the key product contributors, the study team must decide which activities require further investigation through interviews. (2.3.1)
  - After completing the key product interviews, the study team must decide whether an acceptable

percent of response has been received from key product contributors. (2.3.3)

- The study team must be aware that there are limits to the usefulness and validity of the key product analysis data. (2.3.3)

. Office Work Analysis

- Data should be collected for ten working days, regardless of organizational size. Five days, however, is an acceptable minimum. (2.4.1.)

- After completion of the data collection time period, the study team must decide whether an acceptable percent of response has been received from both professional and support staff. (2.4.1)

- In performing the follow-up interviews, a sample should be drawn from both professional and support staffs. (2.4.2)

- Management should participate in determining those productivity measures which appear to be meaningful to the organization. (2.4.3)

- If a significant variance exists between the the data collected during the key product and office work analyses, the study team must determine the reasons behind this variance before proceeding with the study. (2.4.3)

- The study team must be aware that there are limits to the usefulness and validity of the office work analysis data. (2.4.3)

The study team must also remember not to:

. Add, delete, or modify any responses received from a staff member during both data collection efforts unless that individual has concurred.

. Eliminate any data collection steps from either the key product or office work analyses.

3. DESIGNING THE OFFICE AUTOMATION SYSTEM

3.1. Introduction

This chapter of the guideline focuses on the methodology for creating a macro level design model of the office automation system. As a first step in this effort, the baseline productivity data are translated into a set of system requirements which are expressed in quantitative terms so that measurable and comparable key product preparation improvements can be defined. System requirements are statements of design intent and must answer the question, "What is the system required to do?"

Once the requirements have been determined, a system design model is prepared by identifying proposed modifications to each phase of key product preparation. These modifications are generally a combination of organizational, procedural, and technological changes.

Where possible, the expected effect of each change is estimated independently so that the alternatives can be ranked. In many cases, though, a set of changes has a synergistic effect (for example, a technological change may require procedural and organizational changes to be effective); in such cases the set should be considered as a whole. Those changes or sets of changes which appear to have the best productivity potential are incorporated into the system design model and further defined.

3.2. Determining the System Requirements

System requirements are a statement of user needs and organizational objectives in quantitative terms. They are derived by comparing baseline productivity data to a set of productivity goals where the differences between the baseline data and the productivity goals become the requirements of the office automation system. If the performance of this study relates to a newly established office, or one which is being assigned significant new responsibilities, the study team determines the system requirements based on their understanding of the type and amount of work to be performed. Requirements are stated in quantitative terms to permit comparative analyses of proposed productivity improvements. In addition, they consider projected changes to the baseline organizational environment to better reflect expected conditions at the time of system implementation.

As a first step in determining the system requirements, the study team identifies productivity goals to be achieved

by the office automation system. During the previously conducted senior management interviews (Section 2.2.4), the study team noted the relevant productivity factors of each key product. Responses received concerning each factor (i.e., timeliness, responsiveness, convenience, and appearance) indicated its relative importance to the senior managers in terms of key product preparation. For example, if timeliness was identified as a primary concern for a particular key product, the suggested productivity goal may be to reduce revision typing time. If convenience was cited as a primary concern, the suggested productivity goal may be to reduce professional effort expended during the product input phase. Key product contributor interview notes are also reviewed to identify suggested productivity goals. The study team uses these data, together with the senior management interview results, and prepares a set of composite productivity goals for all key products. The proposed system requirements are determined by comparing these goals to the baseline data.

When determining system requirements, the study team considers projected changes to the baseline environment. Will the demand for the organization's products, services, programs, or responses be changing in the near future? If so, such changes may very well have an impact on the proposed office automation system. To account for these changes, the proposed requirements attempt to reflect the projected organizational status at least two years in the future. Data on the projected changes to the baseline were previously collected during the senior management interviews (Section 2.2.4).

The study team also uses judgement in ensuring the feasibility and significance of the proposed requirements. For example, the baseline data may indicate that certain activities are already being accomplished quite efficiently, leaving little room for further improvement. System requirements must therefore represent significant improvements to baseline productivity based on team judgement.

There are no specific limits on the number of system requirements that can be proposed. Using the data collected on productivity goals and key products, the study team derives a set of requirements that appear to meet the needs of the organization under study. To ensure that the most important needs are met the proposed system requirements are prioritized and presented to organizational management for approval and/or modification. Once approved, the requirements are used as a basis for constructing a design model for the office automation system.

3.3. Creation of a System Design Model

The system design model is a blueprint for satisfying the system requirements to effect productivity improvements. These improvements are derived from three types of changes -- organizational, procedural, and technological.

- An organizational improvement opportunity occurs when one functional area performs an activity that could be better accomplished by a different area. For example, the baseline results may indicate that delays in the product input phase occur because contributors from three different work groups are involved even though all information can be obtained from one group. An organizational relocation of responsibilities could in this case effect productivity improvement.

- A procedural improvement opportunity is characterized by the inefficient use of professional and/or support staff. For example, the baseline data may indicate that an inordinate amount of effort is expended by professional key product contributors in performing support functions. A procedural shift in responsibilities could, in this case, effect productivity improvement.

- A technological or automation improvement opportunity is identified when there is under-utilization of existing equipment or an unfulfilled need for automated support. For example, the baseline results may indicate that the professional effort expended on retrieving and reformatting existing data could be reduced by installing some form of professional terminal with access to multiple data bases.

These three types of changes may sometimes be effective individually or as alternatives for improving office productivity; more often, they are required to be applied in combination to be effective. New technologies frequently require new procedures and even new organizational structures to be effective. Changes in procedures are sometimes an alternative to new technology. Changes in organizational structure alone frequently result in productivity improvements, but these are often transitory.

As system alternatives are developed, each system requirement is analyzed in terms of these factors. Additionally, the associated behavioral and staffing impacts are considered. Behavioral impacts normally take the form of resistance to change. Staffing impacts relate to the use of appropriate

personnel to perform specific tasks and functions. The study team uses the following baseline data in reviewing these impacts: key product contributor interview notes, office work analysis questionnaires, and baseline key product flow diagrams.

As a result of this review, the study team creates a system design model to achieve the defined requirements. To develop this model, the study team first reviews the results of the key product analysis and the areas of potential productivity improvement that were identified for each individual key product (Section 2.3.3). These improvements are categorized as being organizational, procedural, or technological. From this set of "working papers", a system design model for all key products is prepared that incorporates only those organizational, procedural, and/or technological modifications that will potentially provide the most benefit in achieving the system requirements. (An example is presented in Exhibit 6.) The model may include one or more applicable equipment types for each product preparation phase:

- Input equipment types include dictation devices, optical character readers, etc.
- Production equipment types include word processors, mini-computers, etc.
- Output equipment types include printers, microfilm, etc.
- Distribution equipment types include facsimile, intelligent copiers, etc.

Definitions for these and other representative office automation equipment types are presented in Appendix E, "Technology Assessment".

After the system design model is developed, the study team prepares a new set of key product flow diagrams which detail, by preparation phase, the proposed modifications and the projected professional and support levels of effort. These new flow diagrams are based on the system design model and specify the organizational, procedural, and/or technological modifications to the baseline preparation processes. All components of the system design model are employed but not necessarily within each key product flow. For example, the system design model may include the provision of CRT terminals to aid the professional staff in key product preparation. The capability of each terminal to perform

Exhibit 6 - System Design Model

Organizational	Procedural	Technological
Work group A will be responsible for initial compilation of budget data	• Support staff will prepare first drafts of key products using selectric typewriters with OCR fonts	• Electronic typewriters W/OCR fonts
Work group B will be responsible for researching program information	• Math computations will be performed by professional staff	• Desktop cassette dictation equipment
Work group C will replace work group A in the review of key products relating to grant applications	• Support staff will be designated as product distributors	• OCR reader
	• Professional staff will provide first draft input through the use of dictation equipment	• Stand-alone Display Word Processors
	• Final drafts will be microfilmed rather than filed	• Minicomputer
		• Facsimile
		• Microfilm Reader-Printers

different functions (e.g. automated calendaring, information tracking, personal information retrieval) will depend on the amount and type of contribution that the professional makes toward the preparation of each key product.

The amount of projected productivity improvement is now determined for each key product. Using the interview results from the key product and office work analyses (Sections 2.3, 2.4), the new key product flow diagrams and the data contained in Appendix E (which also focuses on the benefits and detriments of representative office automation equipment), the study team prepares a matrix estimating the projected productivity impact of the proposed technological modifications. Estimates of projected productivity improvements to be achieved as a result of organizational and procedural modifications are similarly determined although Appendix E is not used. Instead, the study team examines the baseline level of effort expended in performing each key product activity and decides what steps will be eliminated as a result of the modifications. The productivity improvement (in terms of reducing the level of effort) is then estimated and included in the matrix. The study team must recognize that it is not always possible to quantitatively segment the specific degree of improvements resulting from organizational, procedural, and technological factors. For example, the productivity improvement associated with a procedural change may be dependent on and interrelated with a corresponding technological modification. The study team may not be able to separate the time savings and will thus find it necessary to report the improvement as resulting from the set as a whole. Ideally, though, the productivity improvement matrix should include the following types of information:

- Baseline Total Hours Required to Prepare Key Products -- The level of effort for each key product is presented in the matrix prepared per instructions in Section 2.3.3. (An example was presented in Exhibit 4.)

- Projected Total Hours to Prepare Key Products as a Result of Organizational Modifications -- This figure illustrates the impact of organizational modifications on baseline productivity for each key product (determined from interview results and the new key product flow diagrams). When computed, this figure is reflected on each new key product flow diagram.

- Productivity Improvements to be Achieved Through Organizational Modifications -- This figure indicates the percentage improvement projected through the implementation of organizational modifications.

- Projected Total Hours to Prepare Key Products as a Result of Procedural Modifications -- This figure illustrates the impact of procedural modifications on baseline productivity for each key product (determined from interview results and the new key product flow diagrams). When computed, this figure is reflected on each new key product flow diagram.

- Productivity Improvements to be Achieved Through Procedural Modifications -- This figure indicates the percentage improvement projected through the implementation of procedural modifications.

- Projected Total Hours to Prepare Key Products as a Result of Technological Modifications -- This figure illustrates the impact (both professional and support) of technological modifications on baseline productivity for each key product (determined from interview results, the new key product flow diagrams, and the data provided in Appendix E). When computed, this figure is reflected on each new key product flow diagram.

- Productivity Improvements to be Achieved Through Technological Modifications -- This figure indicates the percentage improvement projected through implementation of technological modifications.

- Projected Total Hours to Prepare Key Products as a Result of the System Design Model -- This figure illustrates the total impact of organizational, procedural, and technological modifications on baseline productivity for each key product. When computed, this figure is reflected on each new key product flow diagram. Total hours are divided into professional and support contributions for subsequent use in the cost/benefit analysis.

- Productivity Improvements to be Achieved Through the System Design Model -- This figure indicated the percentage of improvement projected through implementation of organizational, procedural, and technological modifications.

The level of effort totals and percentages for each key product are totaled together and averaged to obtain an estimate of the overall projected productivity improvement to be achieved through implementation of the office automation system, represented by each system design model.

Once the office automation system has been designed, the study team should consider estimating projected productivity

improvements for the preparation phases of each key product. This is especially important if the system design model contains many complex and interdependent components. To accomplish this effort, the aforementioned matrix is simply reconstructed for each preparation phase. Thus, if a decision is subsequently reached to proceed with partial implementation of a system design model, the study team will be able to inform management of where the greatest degree of projected productivity exists.

3.4. Summary

This chapter of the guideline presented the methodology associated with creating the proposed design for the office automation system. The following points should be considered during each stage of the effort:

- Determining System Requirements
  - Requirements consider projected changes to the baseline environment to better reflect conditions at the time of system implementation. (3.2)
  - Requirements must be feasible and significant. (3.2)
- Creation of a System Design Model
  - Productivity improvements are achieved through a series of organizational, procedural, and/or technological modifications to the existing key product preparation processes. (3.3)
  - The behavioral and staffing impacts of these types of modifications must be considered prior to developing the system design model. (3.3)
  - A system design model is prepared that incorporates those modifications that will potentially provide the most benefit in achieving the system requirements. (3.3)
  - A new set of key product flow diagrams are prepared resulting from the system design model and detailing the modifications to the baseline preparation processes. (3.3)
  - A matrix is prepared which indicates the projected productivity improvements to be achieved for each key product. (3.3)

4. DEVELOPING FUNCTIONAL SPECIFICATIONS FOR THE OFFICE AUTOMATION SYSTEM

4.1. Introduction

This chapter of the guideline presents the methodology for developing functional specifications for each equipment type incorporated in the system design model. These specifications are expressed in functional terms to permit competitive bidding by numerous equipment vendors. Specifications are statements of required equipment capabilities and answer the question, "What must the equipment do?" Functional specifications are made up of individual support characteristics which specify a desired feature and/or capability. Thus, the study team first defines the support characteristics and then groups them into functional specifications for each equipment type. (Exhibit 7 presents an example.) In this way, vendors will be encouraged to offer alternative means for satisfying the specifications. The study team is also able to determine the feasibility of the specifications and more accurately construct a representative equipment configuration for the subsequent assessment of cost justification.

4.2. Developing Functional Specifications

Functional specifications for office automation equipment are developed from two sources. First, the previously created system design model and new key product flow diagrams pinpoint the generic types of equipment (e.g., dictation, word processing, facsimile) to be used in the office automation system. Second, the baseline office productivity profile identifies the types of work performed, complexity of work, workloads, and work patterns. Using these sources, the study team proposes support characteristics for each proposed equipment type. There is no limit to the number of support characteristics that can be initially proposed. The study team may decide to consider such characteristics as speed, simultaneity, print quality, disk space, etc. The primary consideration is the projected need of the characteristics as determined through examinations of the baseline productivity profile, the new key product flow diagrams, and the system design model. Consider the following example:

> Based on the observation of a significant quantity of unproductive staff time due to uncompleted telephone calls, the study team determines that the use of communicating terminals will aid in professional productivity improvement and incorporates them into the system design model. The baseline productivity profile reveals that the support staff for these professionals are normally engaged in activities causing them to be away from their desks at intermittent time intervals during

Exhibit 7 - Functional Specifications

Functional Specification For Facimile Equipment

Representative Support Characteristics

- Handle volume of 75 to 150 documents per month
- Must transmit and receive
- 2 to 4 minute transmission speed
- Interface with standard telephones
- High resolution (100 lpi x 100 lpi @ 2 min.)
- Accepts document sized 8 1/2" x 11"; 8 1/2" x 14;
- Dial telephone numbers in an unattended mode
- Ability to run a test copy prior to transmission
- Security coding procedure
- Power source: 115V, 60Hz

the normal workday. To make the best use of the proposed communicating terminals, the study team determines that a support characteristic for this equipment is the ability to permit the unattended receipt and storage of transmitted material. Other support characteristics are similarly developed and together represent the proposed functional specifications for the communicating terminals.

4.3. Examination of Functional Feasibility

After the proposed functional specifications are developed, the study team validates their feasibility in terms of potential vendor responses. Before finalizing these specifications, an assessment is made to ensure that they are achievable, presently available, and demonstrable. Caution is continuously exercised during this assessment so as not to narrow available sources to one vendor when possible. To assist the team in this effort, office automation periodicals and vendor brochures are referenced. Representative reference materials are included in Appendix E, Bibliography of Sources of Office Automation Information. The study team also attempts to attend vendor demonstrations of different equipments and arrange visits to organizations presently using similar equipment to that proposed in the system design model.

A primary purpose of these visits is to identify equipment limitations that will impact the feasibility of including certain features in the specifications. For example, one type of limitation arises when there is a support characteristic for simultaneity. As more equipment features are specified to perform simultaneously, the number of available equipment vendors diminishes. This condition often occurs in the case of integrated word and data processing systems. Therefore, the study team reviews each support characteristic and makes a determination of its benefits and drawbacks before preparing the final set of functional specifications.

4.4. Preparation of a Representative Configuration

After the functional specifications are developed, the study team constructs a representative configuration of all proposed equipment types in the system design model to determine the required number of units and their estimated average purchase costs. Information regarding the required number of units is derived from the system design model, the new key product flow diagrams, and the baseline productivity profile. For example, if the system design model indicates that an OCR input reader will be used to support the production phase of many key products, there will be a corresponding effect on the number of word processors required for product production because word processors will not be used

for first draft input. This number is determined by identifying the following types of information from the baseline data: document length, percentage of revision, and timing of input. The number of required units for other equipment types is similarly determined and together become the representative configuration.

The estimated average purchase cost for these units is calculated through a review of the previously indicated office automation periodicals, vendor brochures and the GSA schedule. The study team obtains estimated costs from as many applicable vendors as possible. Purchase costs are used because of their uniform definition among vendors. The terms associated with lease and rental costs vary significantly from vendor to vendor and are difficult to compare. These estimates are averaged for each equipment type and totaled to construct an estimated configuration cost.

To increase the value of these estimates, the study team should organize the configuration costs by preparation phase. Once these efforts are completed, the team may begin to assess the cost justification of implementing the office automation system.

4.5. Summary

This chapter of the guideline presented the methodology associated with developing the functional specifications for the proposed office automation system. The following points should be considered during each stage of the effort:

- Developing Functional Specifications
  - Functional specifications for the office automation equipment are derived from the system design model, the new key product flow diagrams, and the baseline productivity profile. (Section 4.2)
  - Support characteristics are proposed for each equipment type. (4.2)
  - There is no limit to the number of support characteristics that can be proposed for each functional specification. (4.2)
- Examination of Functional Feasibility
  - The study team must ensure that the proposed functional specifications for each equipment type are achievable, presently available, and demonstrable by at least one vendor. (4.3)

- Caution is continuously exercised in assessing the specifications so as not to narrow available sources to one vendor, when possible. (4.3)

- Equipment limitations are considered when assessing the functional feasibility of each equipment type. (4.3)

Preparation of a Representative Configuration

- A representative configuration of all proposed equipment types in the system design model is constructed to determine the required number of units and their estimated average costs. (4.4)

- The estimated average purchase costs for these units are calculated through a review of office automation periodicals vendor brochures, and the GSA schedule. (4.4)

5. ASSESSING THE COST JUSTIFICATION FOR IMPLEMENTING THE OFFICE AUTOMATION SYSTEM

5.1. Introduction

This chapter of the guideline presents the methodology for performing a cost/benefit analysis to assess the practicality of implementing the office automation system.

In simple terms, cost/benefit analysis consists of identifying and quantifying all system costs and all systems benefits (cost savings or avoidances) to determine if positive net benefits have been achieved and to what magnitude. Organizational management can reach an intelligent decision on whether or not to proceed with full implementation of the office automation system, or an incremental implementation of either a portion of the study area or a particular phase (i.e. input, production, output, distribution) of the key product preparation process, based on a prioritization of alternatives in terms of the net benefits.

Positive net benefits are clearly obtained if use of the automated system results in the same volume of key products at lower cost or a greater volume of key products at the same cost. Positive net benefits are also obtained if a greater volume of key products is produced for incrementally less cost (i.e., the unit cost for the key products is reduced, but not the total cost) and if the additional quantities of key products produced have a value to the organization greater than the incremental cost to produce them. (In some organizations there may be no incremental value to increased quantities of key products). Finally, there may be positive net benefits even if none of the preceeding conditions hold, if there is an improvement in the quality of the key products that can be assigned a value. The study team must realize that the assignment of value to incremental volume or qualitative improvement of key products can be a difficult exercise, requiring a thorough examination of the program or service outputs associated with these products.

The data used in performing the cost/benefit analysis are derived from two sources. The representative equipment configuration (Section 4.4) serves as the basis for determining system cost estimates, and the projected productivity improvements (Section 3.3) serve as the basis for estimating annual system cost savings (i.e., benefits). Cost justification is assessed by projecting these estimates over a period of time against the projected costs associated with retaining the baseline system.

Where there are multiple alternatives or where an alternative system can be implemented in stages, each alternative or stage should be analyzed separately so that they can be prioritized. This is complicated by the possibility of a synergistic effect among different components. The study team must use judgment in selecting the best combinations of system components to be analyzed.

5.2. Elements of System Cost

As a first step in performing the cost/benefit analysis, the study team identifies all one-time and recurring cost elements associated with system implementation. One-time costs include those for system development and implementation. Recurring costs relate to staff efforts required for key product preparation and expenses associated with ongoing use of the new automated equipment. These elements, when compiled, are used by the study team to prepare their cost projections for the office automation system.

One-time costs are computed based on the previously prepared estimates for the representative equipment configuration. In addition to the equipment purchase cost, other potential one-time costs include such items as consultant fees, internal analysis efforts, media conversion charges, programming fees, packaged software, office space, initial training time, and initial training materials. The study team lists all of the relevant cost items and computes estimates for each, relying on information provided from sources within the organization (e.g., Data Processing Department), vendors, and professional service firms.

Recurring costs include two major components. The first component is the periodic costs of professional and support efforts required for key product preparation. Baseline data for key products were previously assembled per the instructions provided in Section 2.3 of this guideline. Labor costs typically represent the major cost component of an office automation system, and should include all applicable personnel costs with fringe benefits. The second component includes those projected expenses resulting from system implementation such as equipment maintenance, insurance, training materials, and supplies. The study team lists all of the relevant recurring cost items and computes estimates for each relying on information provided by equipment vendors and supply firms.

5.3. Elements of System Benefit

The primary factors considered in the determination of system benefit are the projected productivity improvements to be achieved as a result of system implementation and their translation into estimated annual cost savings.

The previously collected baseline data reflect the existing annual key product preparation efforts and costs. These were calculated during the key product analysis (Section 2.3). During development of the system design model, the study team performed a productivity analysis to consider its quantitative impact on required key product preparation efforts (Section 3.3). A matrix was constructed which summarized the projected improvements to be achieved through organizational, procedural, and technological modifications.

Using these previously assembled data, the study team estimates the new key product preparation staff costs, assuming system implementation. This is accomplished by multiplying the hourly labor rates for professional and support staff (Section 2.3) by the new levels of effort required to prepare key products. The difference between the baseline preparation and new preparation costs is the estimated annual cost savings to be achieved as a result of system implementation.

These projected savings represent a pool of labor expense that can be managed in different ways. It can be converted to cash savings through staff reduction; it can be applied to other activities or to a qualitative improvement in the key products; or it can be applied to improving the quality of work life in the organization. Selection of the proper mix of these alternative uses for the labor saved through improved productivity is the prerogative of agency management.

5.4. Assessment of Cost/Benefit

The assessment of cost/benefit involves life-cycle financial projections to compare the net costs of the office automation system to those associated with retaining the baseline system. In preparing for this effort, the study team must have completed the baseline profile, prepared estimates of new system costs, and calculated the estimated productivity improvement cost savings to be achieved through system implementation.

Using these data, the study team prepares a matrix (Exhibit 8 presents an example) and first projects the baseline cost of key product preparation, assuming the automated system is not implemented. (Five years is a recommended projection period, although organizational considerations may dictate otherwise.) When developing this projection, recognition must be given to changes in the baseline environment (e.g., workload increases, staff additions), as well as inflation. The completed projection represents a base of comparison for assessing the cost justification of the office automation system.

A second projection is prepared to estimate the gross yearly costs of key product preparation, assuming system implementation. The previously estimated baseline costs are

Exhibit 8 - Cost/Benefit Projections Matrix

		Year 1	2	3	4	5	Total
Retain Baseline System	. Baseline cost of key product preparation[1,4]	$20,000	$27,000	$28,000	$35,000	$39,000	$149,000
Implement Office Automation System	. Baseline cost of key product preparation[2,4]	20,000	21,000	22,000	23,000	24,000	110,000
	. Equipment cost[3]	8,000	8,000	8,000	8,000	8,000	40,000
	. Other one-time costs	6,000	-	-	-	-	6,000
	. Recurring new system costs[4]	2,000	2,200	2,400	2,600	2,800	12,000
	. Gross key product preparation costs	$36,000	$31,200	$32,400	$33,600	$34,800	$168,000
	. Estimated productivity improvement cost savings	5,000	5,000	5,000	5,000	5,000	25,000
	. Net key product preparation costs	$31,000	$26,200	$27,400	$28,600	$29,800	$143,000

*Notes:

1) Additional staff hiring is necessary to meet increased workloads
2) No additional staff is required to meet increased workloads
3) Office automation equipment costs amortized over projection period
4) Inflation considered in estimates.

again indicated for each projection year. The estimated equipment costs are amortized over the projection period and added to the estimated baseline costs. The recurring new system costs (e.g., maintenance, materials and supplies) are also included in the above totals. Finally, the remaining one-time costs (e.g., consultants, initial training) are added to the first projection year total.

To obtain the net yearly costs of key product preparation, the study team indicates the estimated annual productivity improvement cost savings to be achieved as a result of system implementation. This savings is subtracted from the gross yearly costs for each projection year. These net yearly key product preparation costs are totaled and compared to the projected costs of retaining the baseline system.

In reviewing these comparisons, the study team notes if there are significant differences in the timing of the cash flows for the current and proposed systems. If significant differences exist, a discounted cash flow analysis is performed to determine the present value of both projections. This analysis permits a comparison of present and future costs by adjusting for the time value of money. For example, the present value of $100 to be expended one year from today is approximately $90, assuming a 10% interest rate. In general, the present value of $N to be expended Y years in the future, assumming an interest or "Discount" rate of P percent is $N(1-P)^Y$. Once this same method of analysis is completed for the baseline and office automation cost projections, the yearly estimates are again totaled and compared.

5.5. Judging the Cost/Benefit Analysis Results

The study team notes one of three results from the cost/benefit analysis. If the net total projected costs of the office automation system are less than the total costs of retaining the baseline system, office automation is cost justified because the key products can be prepared with fewer hours of key product contributor effort. Hence, these contributors will be able to expend an increased amount of time on other work activities or prepare more key products if there is an increase in work volume, or it may be possible to reduce the number of contributors.

If the net total projected costs of the office automation system are approximately equal to those of retaining the baseline system, the cost justification for office automation may still exist for those organizations where key product workloads are rapidly increasing. This is because office automation may, for no additional cost, handle increasing workloads better than the baseline system.

It may be the case that multiple alternative systems yield one or both of these results. Faced with such an abundance of riches, the study team may proceed to select among these alternatives by ranking the qualitative improvements they yield in terms of the perceived benefit to the organization. These qualitative benefits need not be assigned a value, since the system has already been justified.

If, in the third possible result, the cost/benefit assessment indicates that key product preparation costs will be greater with the office automation system than with the baseline system, office automation is cost justified only if the key product workload is increasing and the quantified value of this increasing product workload exceeds the increased costs of the automated system, or if there are qualitative improvements in the key products that can be assigned a value. The study team must recognize that in many cases the quantification of key product value is a difficult exercise, requiring a detailed study of the organization's programs and services. Hence, management may reach a decision not to proceed with system implementation when only the third result is obtained.

To increase the utility of the cost/benefit analysis, the study team should consider presenting the cost projections by product preparation phase so that management can assess the practicality of partial system implementation. This can be accomplished only if the data previously collected throughout the feasibility study have been organized accordingly. The results for each phase will indicate to management where the greatest degree of cost justification exists.

Finally, the study team should consider performing the cost justification assessment assuming equipment lease or rental, rather than purchase, especially for those organizations with limited capital budgets which nevertheless have a demonstrated need for office automation.

5.6. Summary

This chapter of the guideline has presented the methodology associated with assessing the cost justification for implementing the office automation system. The following points should be considered during each stage of the effort:

- Elements of System Cost
  - The study team identifies all one-time and recurring costs associated with system implementation. (Section 5.2)

- One-time costs are based on the previously prepared estimates for the representative equipment configuration. (5.2)

- Recurring costs relate to the required key product contributor efforts as well as new system cost items such as equipment maintenance, materials and supplies, etc. (5.2)

. Elements of System Benefit

- System benefit refers to a translation of the previously estimated productivity improvements into estimated annual cost savings. (5.3)

- The difference between the baseline and new key product preparation costs is the estimated annual productivity improvement cost savings to be achieved as a result of system implementation. (5.3)

. Assessment of Cost/Benefit

- The study team prepares a matrix and projects into the future the yearly costs of key product preparation, assuming that the office automation system is not implemented. (5.4)

- A second projection is developed assuming system implementation. This projection considers all system costs as well as the estimated productivity improvement impacts. (5.4)

- The net total projected costs for the office automation system is compared to the total projected baseline system costs to assess cost justification. (5.4)

. Judging the Cost/Benefit Analysis Results

- If the net total projected costs of the automated system are less than those of retaining the baseline system, office automation is cost justified because the key products can be prepared with fewer hours of key product contributor effort. (5.5)

- If the net total projected costs of the automated system are approximately equal to those of the baseline system, office automation may be cost justified because increased workloads may be handled better than in the baseline system at no additional cost. (5.5)

- If the net total projected costs of the automated system are greater than those of retaining the baseline system, cost justification may occur only if the quantified value of increased key product workloads exceeds the increased costs of implementing the automated system or if qualitative benefits result that can be valued. (5.5)

- The utility of the cost/benefit analysis can be increased if the cost projections are presented in terms of product preparation phases. (5.5)

6. CONDUCTING POST-IMPLEMENTATION AUDITS OF THE OFFICE AUTOMATION SYSTEM

6.1. Introduction

This chapter of the guideline presents the methodology for performing post-implementation audits of the office automation system. The primary audit objective is to compare projected office productivity (measured per the instructions provided in Chapter 3) to the actual productivity realized through system implementation. The post-implementation audit report, resulting from these efforts, will include recommendations to management for either proceeding with ongoing operations, fine-tuning the system to achieve the desired results, or totally redesigning the system. In any case, a commitment must be made to continually stimulate productivity improvements relating to key product preparation.

A secondary objective of post-implementation audits is to build up an agency data base on the productivity improvements realized through the application of various different technologies in office systems. With the exception of simple word processing, reliable data on productivity improvements to be expected from different technologies is lacking. By carefully collecting data on the agency's own experience, future office automation efforts can be planned with higher confidence in the results. These results can also be shared with other agencies who may be planning similar projects.

Management support must be forthcoming if the primary audit objective is to be achieved. This support should take the form of a commitment to provide adequate staff and time resources to the audit efforts. The required resources vary depending on organizational size and complexity. An audit team ideally composed of different individuals than those who participated in the initial feasibility study is established. These individuals are less likely than the original study team members to have any preconceived biases towards the audit results. Team members must understand their responsibilities and duties during the audit. These encompass the collection and analysis of new productivity data to compare against the original baseline data.

A schedule of periodic audits is developed to determine if the projected system requirements are being realized. These requirements resulted from both the initial senior management interviews and baseline results. They considered organizational changes in products, services, programs, and/or responses.

A plan for conducting post-implementation audits should be incorporated into the established productivity improvement

program of the organization, if such a program exists. This blending will provide the resources for ongoing post-implementation monitoring and support and serve to mesh the audit activity into the overall organizational structure. Incorporation should not be attempted, however, if it necessitates substantial modification of the suggested audit procedure. The benefits to be gained through incorporation must outweigh any potential drawbacks resulting from the differing procedures.

The standard procedure for performing post-implementation audits is as follows: productivity data are collected and analyzed in the same format as that which was prepared during the original baseline study; these audit results are compared to the productivity projections to determine if the system requirements are being achieved; significant differences between expected and actual results are identified, researched, and explained; finally, suggested modifications to improve system effectiveness in relation to the stated requirements are recommended to management.

As a result of this audit, management may decide to take further action towards improving the office automation system. These actions could involve procedural changes pertaining to system use, acquisition of additional or more enhanced equipment, or implementing the next phase of the system, assuming a partial implementation schedule. The purpose of such actions, in all cases, is to correct existing problems or make an effective system even better.

6.2. Timing of Post-Implementation Audits

When should an audit be conducted? The timing associated with performing an audit is an important factor contributing to valid results. If the audit is performed too soon after implementation, meaningful results will not be achieved because of inadequate system break-in time. To realistically determine system effectiveness, the first post-implementation audit should normally occur after the system has been fully operational for a significant period of time (possibly as great as one year). The audit team considers the following types of factors when determining the length of this period:

- System Size -- Larger systems normally include more numerous staff/machine interfaces than smaller systems. This creates a need for ongoing clarifications of staff duties and equipment capabilities during the initial implementation period.

- System Complexity -- The degree of change associated with key product preparation, work procedures, and the general office environment normally indicates system complexity. Complexity is directly

related to the staff learning curves for using the new system.

- Number of System Users -- Because all staff must become familiar with the new equipment and procedures, break-in time is also dependent on the number of system users.

Other factors such as key product preparation cycles and staff vacations vary from organization to organization but must be addressed by the audit team on an equal basis as those cited above.

Vendors can often be of assistance in determining the appropriate system break-in period by providing statistics on average learning curves, user capacity, etc., for their specific equipment. This information should be used with caution, however, because of its source and should not be relied upon exclusively. Other organizations that are using similar equipment can also be of assistance and should be contacted especially for the purpose of validating vendor claims. Information on their previous experiences can be used to identify potential implementation issues, claims, and solutions.

Once the system break-in factors have been considered and evaluated, a schedule of post-implementation audits is developed by the audit team.

6.3. Office Automation Audit Activities

Several methods are used to collect level of effort and cost data on automated operations. Key products analyzed during the baseline study efforts (Section 2.3) are reexamined. New key product flow diagrams (Section 3.3) are modified to reflect any key product preparation changes that occurred as a result of system implementation. An office work analysis is performed in the same manner as during the initial feasibility study. Once these activities have been performed, the audit team is prepared to seek answers to the following questions:

- Have the previously determined system requirements been achieved?

- Is the office automation equipment helping to achieve the expected results?

The system requirements form the basis for comparing audit results with initial study expectations. The actual benefits of the office automation system are determined by the system's ability to achieve or surpass these requirements. Because the office automation system may have been implemented differently from the system design model, all system requirements

may not be achieved. Factors to be considered when assessing these differences include the actual use and performance of the office automation equipment, the administrative procedures associated with key product preparation, the behavior of the staff affected by the system, the previously collected baseline data, and the audit procedure itself. Once the reasons for ineffectiveness are identified, the audit team begins to determine corrective actions which will enable the system to achieve its requirements.

The data collection techniques for the post-implementation audit are similar to those followed during the orginial baseline study. There are differences, however, within each stage of the process. During the performance of preliminary study activities, the audit team should consider the following modifications:

- If the original study team is intact, there is little need to replicate the literature and organizational research. If a new team has been created, the members perform the initial research as well as become familiar with the study methodology presented in this guideline.

- Senior management interviews focus on the same key products that were previously identified and affected by the automated system. The study team obtains comments from the managers regarding their perception of system benefits and drawbacks resulting from automation. New productivity goals indicated by the managers can serve as the basis for determining revised system requirements since they will identify specific areas in need of improvement. Those key products no longer prepared, or those merged with other key products are defined, described, and addressed in relationship to the baseline profile.

During the performance of the key product analysis, the audit team should consider the following modifications:

- Previously prepared key product flow diagrams are updated as required identifying processing points, supporting equipment, and procedural/organizational changes resulting from the implementation.

- The impact of the functional specifications on equipment performance are discussed with the key product contributors to determine their actual contribution to improved productivity. Comments are solicited regarding: the adequacy of specifications to facilitate expected results; suggestions for additional specifications to further impact productivity;

the availability of these features, and the cost effectiveness of including them in the system.

There are no differences between the original baseline study efforts and the audit activities involved for performing the office work analysis.

Once the data collection effort is completed, the audit team performs a comparison of pre-implementation expectations and post-implementation results. The comparison reveals whether or not the system requirements are being achieved. Several factors are considered in this comparison:

- There is a direct relationship between key product preparation efforts and successful achievement of the system requirements. A key product matrix is prepared comparing projected and actual levels of effort and cost required within the office automation system. If the actual levels of effort are significantly greater than the projected expectations, additional interviews with key product contributors are necessary to ascertain the reasons for this condition. If these interviews prove unproductive, an investigation of both the baseline and audit data is warranted.

- The support requirements incorporated as features of the office automation equipment are examined in terms of their individual benefit. The audit team ascertains the degree of benefit, the reasons behind actual performance, and the available alternatives for increasing these benefits. This information is obtained through interviews with key product contributors or an investigation of baseline and audit data.

- Staff and equipment performance is considered on a product-by-product basis. The audit team identifies specific areas of concern in achieving the previously determined system requirements. As a result of this exercise, a set of alternative strategies for improving the system is determined and/or new system requirements established.

- A summary matrix of office work analysis data is prepared comparing the baseline and audit results. The purpose of this matrix is to graphically illustrate changes in efforts and costs expended on various activities as a result of system implementation. Factors included in the matrix replicate those examined during the baseline study. If a comparison of these factors does not indicate

beneficial change, the reasons are identified and evaluated.

All conclusions reached from the above comparisons form the basis for the audit team's report to organizational management. New recommendations concerning further improvements to the office automation system are also included. These recommendations are drawn from the conclusions reached as a result of the post-implementation audit. The quantitative effect of these recommendations are clearly identified for review by management personnel. Summarizing, the audit effort, once completed, provides organizational management with a full assessment of system status regarding productivity improvement and potential future enhancements to effect even greater productivity.

6.4. Summary

This chapter of the guideline presented the methodology associated with post-implementation audits of the office automation system. The following points should be considered during each stage of the effort:

- Timing of Post-Implementation Audits
  - To realistically ascertain system effectiveness, the first post-implementation audit will occur after the system has been fully operational for a significant period of time. (Section 6.2)
  - The determination of adequate break-in time is dependent on several factors including system size, complexity, and number of users. (6.2)
  - Vendors and other users of similar equipment can be of assistance in determining adequate break-in time for the office automation system. (6.2)
- Office Automation Audit Activities
  - The audit team collects level of effort and cost data on automated operations to compare against the baseline data regarding key product preparation. (6.3)
  - The procedures followed during the initial feasibility study are, with a few differences, employed during the performance of post-implementation audits. (6.3)

- The comparison between pre-implementation expectations and post-implementation results reveals whether or not the system requirements are being achieved. (6.3)

- All conclusions reached from the above comparisons form the basis for the audit team's report to organizational management. (6.3)

- New recommendations concerning further productivity improvements to be achieved through office automation are also presented in the audit report. (6.3)

7. SUMMARY ADVICE

This guideline presented a structured approach for determining the feasibility and practicality of implementing (or expanding) office automation systems to effect productivity improvements in Federal agencies. The study methodology entailed the performance of five major activities.

These activities are complex, yet can be successfully accomplished if caution is continually exercised during the course of the study. The following paragraphs are aimed towards assisting the users of this guideline by providing summary reminders of the key cautionary points discussed in the previous chapters. The advice is organized by chapter/section title so that the reader may refer back in the guideline for a more detailed discussion.

DETERMINING BASELINE OFFICE PRODUCTIVITY (Chapter 2)

- Preliminary Study Activities (2.2) -- Team member selection is of critical importance to successful completion of the study effort. If individuals possessing the necessary experience are not available within the organization to participate in the effort, it is advisable to seek outside assistance.

  The study scope can be limited to either a few predetermined key products, a small sector of the organization, and/or to specific product preparation phases. The scope of the effort should be related to either the estimated size of the office automation procurement budget or to the realistic availability of staff resources.

  A "product" is defined as a "unit" of regularly produced written material contributed to by one or more individuals requiring significant amounts of time and cost. Appendix A contains a "Typical List of Products" to help guide the study team in product identification.

  Key products (resulting from the senior manager interviews and subject to further examination) should represent the performance of major office activities and would appear to benefit from the introduction of one or more types of office automation equipment.

  If the study area is large or composed of many functional groups, the data should be summarized by work group, department, or similar functional unit and then collected into an organizational summary. If the study area is small, an organizational study only need be prepared.

- Key Product Analysis (2.3) -- After preliminary level of estimates are provided by the key product contributors, the study team must decide which activities require further investigation through interviews.

  After completing the key product interviews, the study team must decide whether an acceptable percent of response has been received from key product contributors.

  The study team must be aware that there are limits to the usefulness and validity of the key product analysis data.

  While not required, the study team may find it advantageous to examine data regarding the quality of work being performed and the value of the key products to the organization.

- Office Work Analysis (2.4) -- Data should be collected for ten working days, regardless of organizational size. Five days, however, is an acceptable minimum.

  After completion of the data collection period, the study team must decide whether an acceptable percent of response has been received from both professional and support staff.

  In performing the follow-up interviews, a sample should be drawn from both the professional and support staffs.

  Management should participate in determining those productivity measures which appear to be meaningful to the organization.

  If a significant variance exists between the data collected during the key product and office work analyses, the reasons behind this variance must be determined before proceeding with the study.

  The study team must be aware that there are limits to the usefulness and validity of the office work analysis data.

DESIGNING THE OFFICE AUTOMATION SYSTEM (Chapter 3)

- Determining the System Requirements (3.2) -- System requirements are statements of design intent and answer the question "What is the system required to do?"

They are derived by comparing baseline productivity to a set of productivity goals previously identified during the senior manager interviews.

They are stated in quantitative terms to permit comparative analyses of proposed productivity improvements.

They should reflect the projected status of the organization at least two years in the future.

The proposed requirements are prioritized and presented to organizational management for approval and/or modification.

- Creation of a System Design Model (3.3) -- The system design model is a listing of productivity improvement options that can potentially improve the baseline key product preparation processes. Productivity improvement comes from organizational, procedural, and technological sources.

  The behavioral and staffing impacts of each productivity improvement source must be considered.

  The model is developed by first reviewing the results of the key product analysis and the areas of potential productivity improvement that were then identified for each individual key product. From these "working papers," a model for all key products is prepared that incorporates only those modifications that will significantly affect the achievement of the system requirements.

  A new set of key product flow diagrams are prepared to identify the placement of potential productivity improvements to baseline key product preparation. All components of the system design model are employed, but not necessarily within each key product flow.

  A matrix is prepared to indicate the projected quantitative productivity improvements to be achieved for each key product.

  The technology assessment presented in Appendix E can be used to estimate the amount of potential productivity improvements to be achieved as a result of technological modifications. However, this information needs to be continually researched and updated to account for new technological developments which may offer further productivity improvement.

To estimate the potential productivity improvement to be achieved as a result of organizational and procedural modifications, the study team examines the baseline level of effort expended in performing each key product activity. The study team uses its best judgment in determining what steps will be eliminated as a result of the modifications. Productivity improvement (in terms of reducing the level of effort) is then estimated and included in the matrix.

DEVELOPING FUNCTIONAL SPECIFICATIONS FOR THE OFFICE AUTOMATION SYSTEM (Chapter 4)

- Developing Functional Specification (4.2) -- Specifications are expressed in functional terms to permit competitive bidding by numerous equipment vendors.

  They are made up of individual support characteristics which specify a desired feature and/or capability.

  They are derived from two sources. First, the previously created system design model and new key product flow diagrams pinpoint the generic types of equipment to be used in the office automation system. Second, the baseline office productivity profile identifies the types of work performed, complexity of work, workloads, and work patterns.

  The study team first defines the support characteristics and then groups them into functional specifications for each equipment type.

  There is no limit to the number of support characteristics that can be initially proposed for each functional specification.

- Examination of Functional Feasibility (4.3) -- The study team must ensure that the proposed functional specifications for each equipment type are achieved, presently available, and demonstrable by at least one vendor.

  Caution is continually exercised so as not to narrow available sources to one vendor, when possible.

  The limitations of each equipment type are considered by referencing office automation periodicals and brochures, attending vendor demonstrations, and visiting other organizations using similar equipment.

Each support characteristic is reviewed in terms of its benefits and drawbacks before preparing the final set of functional specifications.

- Preparation of a Representative Configuration (4.4)--Information regarding the required number of units is derived from the system design model, the new key product flow diagrams, and the baseline productivity profile.

  The estimated average purchase costs for these units are calculated through a review of the previously indicated office automation periodicals, vendor brochures, and the GSA schedule.

  Purchase costs are used because of their uniform definition among vendors. The terms associated with lease and rental costs vary significantly from vendor to vendor and are difficult to compare.

  The cost estimates are averaged for each equipment type and totaled to construct an estimated configuration cost.

ASSESSING THE COST JUSTIFICATION FOR IMPLEMENTING THE OFFICE AUTOMATION SYSTEM (Chapter 5

- Elements of System Cost (5.2) -- The study team identifies all one-time and recurring costs associated with implementing the office automation system.

  One-time costs include such items as equipment, implementation analysis, programming, training.

  Recurring costs include such items as equipment, maintenence, materials and supplies, required key product contributor efforts.

- Elements of System Benefit (5.3) -- System benefit refers to a translation of the previously estimated productivity improvements into estimated annual cost savings.

  The difference between the baseline and new key product preparation costs is the estimated annual productivity improvement cost savings to be achieved as a result of system implementation.

- Assessment of Cost Benefit (5.4) -- A matrix is prepared that projects into the future the yearly costs of key product preparation, assuming that the office automation system is not implemented.

A second projection is developed assuming system implementation and considers all system costs as well as the estimated productivity improvement impacts.

The net total projected costs for the office automation systems are compared to the total projected baseline system costs to assess cost justification.

If there are significant yearly differences between the baseline system costs and the net costs of the automated system, a discounted cash flow analysis may be performed to determine the present value of both projections.

- Judging the Cost/Benefit Analysis Results (5.5) -- If the net total costs of the automated system are less than those of retaining the baseline system, office automation will result in an absolute cost savings and is justifiable.

  If the automated and baseline system costs are approximately equal, office automation may be cost justified because increased workloads can be handled at no additional cost.

  If the automation costs are greater than the baseline costs, the system will be cost-justifiable only if the quantified value of increased product workloads exceeds the cost of implementing the automated system.

CONDUCTING POST-IMPLEMENTATION AUDITS OF THE OFFICE AUTOMATION SYSTEM (Chapter 6)

- Timing of Post-Implementation Audits (6.2) -- The first audits should occur after the system has been fully operational for a significant period of time, possibly as great as one year.

  The determination of adequate break-in time is dependent on several factors including system size, complexity, and number of users.

  Vendors and other users of similar equipment can be of assistance in determining adequate break-in time.

- Office Automation Audit Activities (6.3) -- The primary audit objective is to compare projected office productivity to the actual productivity realized through implementation of the office automation system.

  An audit team should be established and ideally composed of different individuals than those participated in the initial feasibility study. These

are less likely than the original study team members to have any preconceived biases toward the audit results.

The procedures employed during the post-implementation audits are similar to those followed during the initial feasibility study, although there are modifications to the data collection forms.

The comparison between pre-implementation expectations and post-implementation results reveals whether or not the system requirements are being achieved.

All conclusions reached from these comparisons form the basis of the audit team report to organizational management. The report recommends to either proceed with ongoing operations, fine-tune the system to achieve the desired results, or totally redesign the system.

New recommendations concerning further productivity improvements to be achieved through office automation are also presented in the audit report.

Each chapter of the guideline should be thoroughly reviewed by the study team before embarking on any activity described herein. Additionally, organizations should approach office automation in a cautious, organized manner, understanding that not all areas of the office are susceptible to automated improvements.

As a final caution, management must recognize that the value of office automation improvements will be optimized only if the newly available time of professional and support staffs are directed toward new or additional activities designed to improve organizational effectiveness. This is the challenge to organizations that are deciding to introduce office automation or any other types of productivity improvement measures.

APPENDICES

APPENDIX A

SAMPLE

TYPICAL LIST OF PRODUCTS

1. Correspondence:
   - Letter
   - Memorandum
   - Message

2. Reports:
   - Management
   - Trip
   - Technical
   - Incident
   - Project Status
   - Fiscal
   - Personnel
   - Weekly Activities
   - Material Deficiency
   - Training

3. Documents:
   - Statement of Work (SOW)
   - Specifications
   - Procurement Plan
   - Program Management Directive
   - Program Management Plan
   - Letter Request
   - Sole Source Justification
   - Determination and Finding (D&F)
   - Invitation for Bid
   - Request for Proposal (RFP)
   - EEO Certification
   - Small Business Coordination
   - Pre-Award Survey
   - Model Contract
   - Change Order
   - Administrative Notice
   - Source Selection Plan
   - Annual Call for Estimate
   - Obligation Authority (AO)
   - Procurement Directive
   - Delivery Order
   - Cost Estimate
   - Independent Cost Analysis (ICA)
   - Contract Funds Status Report (CFSR)
   - Staff Meeting Agenda (and Report)
   - Action Item List
   - Configuration Change Status Report (CCSR)
   - Engineering Change Proposal (ECP)
   - Quarterly Resources Report

System Safety Program Plan
Configuration Control Board Minutes
Data Management Report
Training Plan
Integrated Logistics Support Plan (ILSP)
Program Management System Checklist
Contract Management Systems Checklist
Military Construction Program Reporting
Site Survey Report
Environmental Assessment
Life-Cycle Cost Study
Phase-Out Plan

4. Forms:

Contract Data Requirements List (CDRL)
Security Classification Guide
Inspection and Acceptance Document
Data Item Description
Personnel Action Request
Time Card
Work Order Request
Security Monitor
Printing Request
Position Description
Purchase Request
Report of Survey
Travel Request
Military Order

5. Reviews/Briefings:

Business Strategy Panel Meeting
Quarterly Financial Review
Periodic Program Review
Program Management Review (PMR)
Executive Management Review (EMR)
Resources Utilization Committee (RUC) Action
Financial Management Board Review
Division Advisory Group (DAG) Review
Scientific Advisory Board (SAB) Meeting
Command or Senior Officer Briefing
Internal Management Review

6. Audiovisual Aids:

Vugraph
Briefing Text
Graphic Aid
35mm Slide
Briefing Board

APPENDIX B

DEFINITIONS OF TERMS

Tasks

Planning - Formulating an idea to be expressed in written or graphic form that lays out a method for achieving an end (e.g., scheduling).

Consulting - Giving advice or exchanging opinions with colleagues (superiors, peers, or subordinates) to discuss or consider a wider range of viewpoints. Consulting might be accomplished by telephone, a meeting, or an individual face-to-face encounter.

Collecting Data - Assembling facts from various sources to use in preparing documents or responses to inquiries.

Evaluating, Sorting,and Analyzing - Examining and judging material to assess its value.

Preparing Drafts - Transferring thoughts from one's mind into another medium (usually paper) either with a writing tool or by use of mechanical or electronic means.

Reviewing and Revising Drafts - Performing a critical evaluation of work (yours or others) with the expected outcome of change in format, grammer, or content.

Coordinating - Circulating a document or response to inquiry for comment as to content or procedure. It is usually accomplished by written annotation or telephone.

Obtaining Approvals - Requesting approval of a decision maker to proceed with an action, document, or response to inquiry.

Disseminating - Dispensing material to a list of authorized recipients.

Maintaining Records - Assembling and holding materials in some container in an orderly manner that assists in quick recovery. For the professional, it may be a desk drawer, notebook, file folder, or small container.

Functions

Typing - Preparing materials through use of a typewriter.

Dictating - Speaking for someone else to write down or for recording on some medium.

Transcribing - Copying from one medium to another or producing typed material from dictation.

Filing - Arranging material (usually on paper) into a particular order for future reference.

Duplicating - Making copies through use of a copier or duplicator.

Distributing - Sending or taking materials to authorized recepients and filing areas.

Printing - Producing typed pages of previously input material.

Communicating - Using automated equipment to transmit materials to remote location.

Data Processing - Inputting, processing, and/or outputting material under the control of a stored program.

NAME _____

DATE _____

WORKSHEET FOR _____ TOTAL HOURS _____
(Product/Activity)

TASKS (PROFESSIONAL LEVEL)	PROFESSIONAL PERSONHOURS	FUNCTIONS BY YOU (type and hours)	FUNCTIONS BY SUPPORT (type and hours)
PLANNING			
CONSULTING			
COLLECTING DATA			
SORTING & EVALUATING DATA			
PREPARING DRAFT			
REVIEWING/REVISING DRAFT			
COORDINATING			
OBTAINING APPROVALS			
DISSEMINATING			
MAINTAINING RECORDS			

SUPPORT TYPE FUNCTIONS

1. TYPING
2. DICTATING
3. TRANSCRIBING
4. FILING
5. DUPLICATING
6. DISTRIBUTING
7. PRINTING
8. COMMUNICATING
9. DATA PROCESSING

SAMPLE

Name_____

Date _____

Product_____

KEY PRODUCT INTERVIEW GUIDE

TASK QUESTION

1. Would you describe your work in accomplishing each task identified on the worksheet?

ACTIVITY QUESTIONS

2. In performing the activity described on the worksheet, what inputs were required from other people/ offices?

what	from where	how (mail, etc.)	how long
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

SAMPLE

3. Which inputs listed in question #2 were critical for your continuing to progress in this activity?

_____

_____

_____

_____

_____

4. To what degree did you have to manipulate the inputs listed in question #2 to accomplish your activity?

	heavy	moderate	light	not at all
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

5. Did you experience any problems or delays in doing your work?

_____ yes _____ no

If yes, what was the cause and the result?

6. If clerical support type functions were performed by you, why?

SAMPLE

7. Can you estimate the extent to which you used the office equipment listed below?

hours of use

_____ typewriter

_____ word processor

_____ copier

_____ telephone

_____ facsimile

_____ dictation equipment

_____ other (explain:_____)

8. Do you maintain any files on the product?

_____ yes _____ no

If yes, for what purpose?

PRODUCT SUMMARY

9. Do you have any suggestions -- organizational, procedural, or technological -- for improvement of product preparation?

_____ yes _____ no

If yes, what and how would it help?

APPENDIX D

OFFICE WORK ANALYSIS

Date: _____

SAMPLE

PROFESSIONAL QUESTIONNAIRE

Name_____ Years in Present Position_____

Title_____ Years with Organization_____

Office_____ Full Time _____ Part Time_____ (#hrs_____)

JOB CHARACTERISTICS

1. Was your workload during the study period:

   _____ lighter than normal

   _____ normal

   _____ heavier than normal

2. Are you now performing any administrative functions that could be delegated to a secretary if the support were available?

   _____ typing
   _____ proofreading
   _____ photocopying/collating
   _____ filing
   _____ telephone coverage
   _____ mail sorting/delivery
   _____ composing letters, etc.
   _____ taking dictation
   _____ posting information
   _____ preparing forms/longhand
   _____ math calculations
   _____ research
   _____ maintaining office
   _____ business errands
   _____ using facsimile
   _____ other (what?_____)

3. Can you think of any repetitive activities you perform (e.g., record-keeping, math computations, data analysis, etc.) that could be done more effectively using automated tools?

   _____ yes _____ no

   If yes, please describe.

   _____

   _____

   _____

SAMPLE

INFORMATION/DATA SOURCES

4. What percent of the information/data that you need during an average week is produced by:

_____ % your office

_____ % other offices in your organization

_____ % other government agencies (who? _____)

_____ % other sources (who? _____)

100 %

In what format do you usually receive this information?

_____ % computer printout

_____ % handwritten

_____ % typed

_____ % other (explain: _____)

100%

5. What percent of the information/data that you need during an average week is existing information in your organization that you must collect and reformat for your own use? _____ %

6. To what extent do you have problems receiving the information in question 5 on a timely basis?

_____ very often _____ sometimes

_____ often _____ rarely

If problems, please describe _____

_____

_____

SAMPLE

LEVEL OF SECRETARIAL SUPPORT

7. Who provides most of your secretarial support?

_____ my personal secretary

_____ a secretary I share with others

_____ several secretaries I share with others

_____ no one, I do my own clerical work (SKIP TO QUESTION 14)

What is the name(s) of your secretary(ies)?

_____

8. If you share secretaries, how many other professionals do they support (excluding yourself)? _____

9. When the secretary is absent, how do you get your work done?

_____ wait for secretary to return

_____ request support elsewhere as favor

_____ other (explain: _____)

10. When you are out of the office for a full day or more, how does your secretary(ies) usually spend his or her time?

_____ does work assigned by me

_____ catches up on work that has backlogged

_____ does what needs to be done

_____ works for other people he or she regularly supports

_____ assigned temporarily to another work group/department

_____ do not know

11. Does your secretary get assistance when work gets backlogged?

_____ yes _____ no

If yes, how: _____

_____

SAMPLE

12. How satisfied are you with the level of secretarial support provided:

_____ very satisfied _____ somewhat satisfied

_____ satisfied _____ not satisfied

13. What are the five most critical functions the administrative support staff performs for you during an average week?

_____ typing _____ posting information

_____ proofreading _____ preparing forms/longhand

_____ photocopying/collating _____ math calculations

_____ filing _____ research

_____ telephone coverage _____ maintaining office

_____ mail sorting/delivery _____ business errands

_____ composing letters, etc. _____ using facsimile

_____ taking dictation _____ other (what?_____)

14. How would you describe your need for secretarial support?

_____ steady _____ peaks and valleys

If you checked peaks and valleys, when do peaks occur?

_____ particular time(s) of day (why? _____)

_____ particular day(s) of week (why? _____)

_____ particular month(s) (why? _____)

_____ unpredictable

DICTATION

15. During an average week, do you dictate?

_____ yes _____ no

If yes, you dictate to:

_____ secretary (who:_____)

_____ dictation equipment

SAMPLE

16. What documents do you dictate?

_____ 1 page

_____ 2-5 pages

_____ 6-10 pages

_____ over 10 pages

17. If you have access to dictation equipment, but do not use it, why?

_____

_____

18. Have you ever received dictation equipment training?

_____ yes, from vendor _____ no

_____ yes, from other source (who? _____)

If yes, was it helpful? _____ yes _____ no

19. Would you like to receive (additional) dictation training?

_____ yes _____ no

20. If you do not currently have access to dictation equipment, would you like to use it?

_____ yes _____ no (why? _____)

TYPING REQUIREMENTS

21. What are your total typing requirements during a week?

	typical week	heavy week
1-5 pages	_____	_____
6-10 pages	_____	_____
11-19 pages	_____	_____
20 or more pages	_____	_____

SAMPLE

22. What is the average number of typed pages in documents you generate during the week?

_____ 1	_____ 4-9	_____ 20-40
_____ 2-3	_____ 10-19	_____ over 40

23. What percent of the typed work you generate weekly consists of:

_____ % original text

_____ % standardized text

_____ % columns of numbers (statistical)

_____ % pre-printed forms fill-ins

_____ % graphics/illustrations

_____ % other (explain _____)

100 %

24. When you find secretarial errors in your typing, what usually happens?

_____ use white-out is used

_____ retype entire page

_____ retype corrections on original page

_____ write corrections by hand

_____ other (explain _____)

25. Is the level of typing support available to you adequate?

	typical week	heavy week
adequate	_____	_____
not adequate	_____	_____

If "not adequate", why? _____

_____

SAMPLE

26. What percent of the work you submit for typing during an average week is:

_____ % typed by you

_____ % written completely in longhand

_____ % dictated to a secretary

_____ % dictated on equipment

_____ % cut and pasted (including some longhand)

_____ % computer generated

_____ % extracted from previously typed materials

_____ % other (explain: _____)

100 %

27. If you type yourself either in draft or final form, why?

_____ personal preference

_____ hasten turnaround time

_____ secretary not available

_____ other (explain: _____)

28. Do revisions cause problems in meeting typed material deadlines?

_____ very often _____ sometimes

_____ often _____ rarely

If often, why? _____)

29. How satisfied are you with the appearance of documents leaving the office?

_____ very satisfied _____ somewhat satisfied

_____ satisfied _____ not satisfied

If not satisfied, why? _____)

SAMPLE

30. For what percent of the work you submit for typing during an average week do you assign priorities?

_____ % high priority (immediate attention)

_____ % standard (a day or less)

_____ % low (next several days)

_____ % no priority assigned

100 %

Are your priorities usually met?

yes	no	
_____	_____	high priority
_____	_____	standard
_____	_____	low

FILING

31. What files do you regularly access?

_____ active (regularly used by one or more individuals; contains materials ralating to on-going activities)

_____ inactive (regularly used by one or more individuals; contains archival records)

_____ other (what? _____)

32. Who does the initial filing?

	active files	inactive files
I do	_____	_____
other professionals	_____	_____
my secretary	_____	_____
other scretaries	_____	_____

SAMPLE

33. Who usually retrieves and returns materials to the files?

	active files	inactive files
I do	_____	_____
other professionals	_____	_____
my secretary	_____	_____
other secretaries	_____	_____

34. How often do you use file materials during an average week?

	active files	inactive files
several times/day	_____	_____
once a day	_____	_____
2 or 3 times/week	_____	_____
once a week or less	_____	_____

35. Is file access a problem?

_____ yes _____ no

If yes, why? _____

_____

_____

PHOTOCOPYING REQUIREMENTS

36. What percent of your photocopying during an average week is done by:

_____ % you

_____ % another professional

_____ % secretarial staff

_____ % duplication/print shop

_____ % other (explain: _____)

100 %

SAMPLE

37. Approximately how many pages do you copy or have copied for you?

	pages
typical week	_____
heavy week	_____

38. What is the total number of copies you usually make or have made during a typical week? _____ copies

39. How satisfied are you with the quality of photocopies?

_____ very satisfied _____ somewhat satisfied

_____ satisfied _____ not satisfied

DISTRIBUTION

40. How much of your work during an average week is distributed through:

_____ % internal mail within building

_____ % internal mail outside building

_____ % hand-carried inside office

_____ % hand-carried outside office

_____ % U.S. Mail

_____ % facsimile

_____ % commercial Air Express

_____ % other (how? _____)

100 %

41. On average, how long does it take for you to receive documents via internal mail from others?

_____ less than a half day

_____ one day

_____ two days

_____ other (how long? _____)

SAMPLE

42. Is the internal mail system responsive to your needs?

_____ yes _____ no

If no, why? _____

_____

_____

If no, how do you compensate?

_____ facsimile

_____ hand-carrying

_____ other (what? _____)

43. What materials do you usually not send via internal mail?

_____

_____

_____

_____

Why?

_____ for review, coordination

_____ for discussion

_____ to hasten processing

_____ other (explain: _____)

THANK YOU FOR YOUR HELP.

SAMPLE

Date:_____

ADMINISTRATIVE SUPPORT QUESTIONNAIRE

Name_____ Years in Present Position_____

Title_____ Years with Organization_____

Office_____ Full Time_____ Part Time_____ (#hrs___)

JOB CHARACTERISTICS

1. Was your workload during the study period:

   _____ lighter than normal

   _____ normal

   _____ heavier than normal

2. Can you think of any repetitive activities you perform (e.g., recordkeeping, math computations, data analysis, etc.) that could be done more effectively using automated tools?

   _____ yes _____ no

   If yes, please describe.

   _____

   _____

   _____

3. How many people do you regularly provide the following support to?

   number of people

   _____ secretarial/administrative support

   _____ telephone coverage

   Who is primary support provided to?

   _____

4. Do you feel the people you support are aware of how much work you have?

   _____ usually _____ sometimes _____ rarely

SAMPLE

5. What do you feel are the five most critical functions you perform for the people you regularly support during an average week?

_____ typing
_____ photocopying/collating
_____ filing
_____ telephone coverage
_____ mail sort/delivery
_____ composing memos/letters
_____ taking dictation
_____ transcribing
_____ posting information
_____ preparing forms in longhand
_____ doing math calculations
_____ research
_____ maintaining office
_____ business errands
_____ using facsimile
_____ other (what?_____

6. How would you describe your workload?

_____ steady _____ peaks and valleys

If you checked peaks and valleys, when do peaks occur?

_____ particular time(s) of day (why? _____)
_____ particular day(s) of week (why? _____)
_____ particular month(s) (why? _____)
_____ unpredictable

7. Who usually prioritizes your work?

_____ I do
_____ person I primarily support
_____ all the people I support
_____ secretarial supervisor or head secretary
_____ other (explain:_____

_____

SAMPLE

8. If you receive assistance when your work gets backlogged, how are other secretaries asked for help?

_____ I don't get any assistance

_____ I ask them

_____ head secretary asks them

_____ person(s) I support asks them

_____ other (explain:_____)

9. How often does your work get backlogged to the extent that extra assistance would be helpful?

_____ very often (once a week or more)

_____ often (several times a month)

_____ occasionally (every few months)

_____ rarely (several times a year)

10. When the people you work for are out of the office on business for a full day or more, how do you usually spend you time?

_____ I do work assigned by the people I regularly support

_____ I catch up on work that has backlogged

_____ I do what I feel needs to be done

_____ I am assigned temporarily to another work group/department

11. Does someone else handle your work when you are on vacation or absent?

_____ usually _____ sometimes _____ rarely

12. Do you maintain a procedures book detailing your secretarial responsibilities?

_____ yes _____ no

	yes	no	don't know
If you keep a procedure book, could it be improved?	___	___	___
Do you follow it regularly?	___	___	___
Could another person use it to do your work?	___	___	___
Does the person(s) you support review it periodically?	___	___	___

SAMPLE

13. How many hours do you work overtime during a typical week?
_____ hours

DICTATION

14. Do you take dictation?

_____ yes _____ no

If no, why? _____

_____

15. Do you have access to transcription equipment?

_____ yes _____ no

If yes, do you use the transcription equipment?

_____ yes _____ no (why?_____)

16. What is your reaction to transcribing from equipment?

_____ never used it _____ like it _____ dislike it

If you dislike, why?_____

TYPING

17. On what kind of equipment do you now do your typing?
(Check all that apply)

_____ do not type

_____ typewriter

_____ word processor (manufacturer & model)_____

SAMPLE

18. What is your total typing output during a week?

	typical week	heavy week
1-5 pages	___	___
6-10 pages	___	___
11-19 pages	___	___
20 or more pages	___	___

19. What is the average number of pages in documents you typed during a week?

_____ 1 _____ 4-9 _____ 20-40

_____ 2-3 _____ 10-19 _____ over 40

20. What percent of your weekly typing consists of:

_____ % original text

_____ % standardized text

_____ % columns of numbers (statistical)

_____ % pre-printed forms fill-ins

_____ % graphics/illustrations

_____ % other (explain _____)

100%

21. When you find typing errors in your work, what usually happens?

_____ use white-out is used

_____ retype entire page

_____ retype corrections on original page

_____ write corrections by hand

_____ other (explain _____)

SAMPLE

22. What percent of the work you type during an average week is submitted:

_____ % written completely in longhand

_____ % dictated to you

_____ % transcribed

_____ % cut and pasted (including some longhand)

_____ % computer generated

_____ % previously typed

_____ % other (explain _____)

100%

23. For what percent of the work you type during an average week has a priority been assigned?

_____ % high priority (immediate attention)

_____ % standard (a day or less)

_____ % low (next several days)

_____ % no priority assigned

100%

24. How satisfied are you with the appearance of documents you type when they leave the office?

_____ very satisfied _____ somewhat satisfied

_____ satisfied _____ not satisfied

If not satisfied, why_____

_____

25. How interested are you in using (or learning to use) a word processor?

_____ very interested _____ somewhat interested

_____ interested _____ not interested

SAMPLE

FILING

26. What files do you regularly access?

_____ active (regularly used by one or more individuals; contains materials relating to on-going activities)

_____ inactive (regularly used by one or more individuals; contains archival records)

27. Who does the initial filing?

	active files	inactive files
I do	_____	_____
professional(s) I support	_____	_____
other professionals	_____	_____
other secretaries	_____	_____

28. Who usually retrieves and returns materials to the files?

	active files	inactive files
I do	_____	_____
professional(s) I support	_____	_____
other professionals	_____	_____
other secretaries	_____	_____

29. If you obtain and return materials, how often?

	active files	inactive files
several times a day	_____	_____
once a day	_____	_____
2 or 3 times/week	_____	_____
once a week or less	_____	_____

30. Is file access a problem?

_____ yes _____ no

If yes, why _____

_____

SAMPLE

PHOTOCOPYING

31. Approximately how many pages do you copy?

	pages
typical week	_____
heavy week	_____

32. What is the total number of copies you usually make during a typical week? _____ copies

33. How satisfied are you with the quality of photocopies you make?

_____ very satisfied _____ somewhat satisfied

_____ satisfied _____ not satisfied

DISTRIBUTION

34. How much of your work during an average week is distributed through:

_____ % internal mail within building

_____ % internal mail outside building

_____ % hand-carried inside office

_____ % hand-carried outside office

_____ % U.S. Mail

_____ % facsimile

_____ % commercial Air Express

_____ % other (how? _____)

100%

35. On the average, how long are the distribution lists you use?

_____ I do not use distribution lists

_____ 1-6 addresses

_____ 7-10 addresses

_____ over 10 addresses

SAMPLE

36. How often do you use your distribution lists?

_____ 3-4 times a week or more

_____ 1 or 2 times a week

_____ once or twice a month

_____ less than once a month

37. Do you hand-carry materials to other offices?

_____ yes _____ no

If yes, on the average how often and where?_____

_____

38. Do you use facsimile equipment?

_____ yes _____ no

If yes, on the average how many pages do you send and/or receive each week?

_____ pages sent _____ pages received

THANK YOU FOR YOUR HELP.

SAMPLE

WORD PROCESSOR SUGGESTED QUESTIONS

1. How many hours a week do you usually use the word processor?

   _____ # hours

2. How would you rate the ease of operating your automated equipment?

   _____ very easy

   _____ easy

   _____ difficult

   _____ very difficult

3. Who trained you initially to use the word processor?

   _____

4. Do you keep a paper copy of materials stored on cards, cassettes, diskettes, or discs?

   _____ always _____ occasionally

   _____ usually _____ rarely

   If so, why?_____

5. If you have access to a word processor but do not use it, why?

   _____

   _____

APPENDIX E
TECHNOLOGY ASSESSMENT

Descriptions of Product Preparation Phases
and Representative Equipment Types

A wide variety of office automation technologies are available for use in performing various functions. For the purposes of this guideline, these technologies are categorized into four phases of product preparation: input, production, output, and distribution.

- The input phase includes the conversion of ideas or thoughts into complete and concise verbal or written communications. Representative equipment includes:

  - Dictation Equipment -- Designed for local and/or remote dictation. Originator accesses individual unit or central system via microphone, hardwired handset, or telephone. If a centralized system is used, it may be configured to handle from two or three to an unlimited number of originators.

  - Electronic Typewriter with Optical Character Recognition Font Capability -- Aids the user in the preparation of first draft text. Has an internal memory only and generally offers such text features as automatic centering, decimal tabulation, and automatic error correction. OCR font allows text to be read into production phase equipment for further processing.

  - Optical Character Recognition(OCR) -- Reads through a process of light-sensitive recognition, specially prepared pages of text and translates the copy into electronic impulses for storage on magnetic media. The media is used as input for text editing on compatible word processing equipment or other types of production equipment. OCR systems are usually stand-alone devices.

  - Personal (Professional) Terminals -- Provides the opportunity for the professional to directly input data into or retrieve it from production-type equipment. Data may be used for later processing or text editing. The value to an organization is totally dependent on the type of application.

- The production phase consists of processing or manipulating the ideas or thoughts created and/or stored during the input phase. It may include word processing or data processing. Representative equipment includes:

  - Blind Automatic Word Processor -- Aids user in the preparation of original typing and limited text editing. Includes keyboard, internal memory, and magnetic media storage/retrieval capability (usually magnetic card or tape). The printer unit is the same as the keyboard unit.

  - Stand-Alone Display Word Processor -- Aids secretary in the preparation of original typing and extensive text editing. Some have records/list processing capabilities. Has keyboard, internal memory, and magnetic media storage/retrieval capability. The video display may be a one-or-two line window up to a full page CRT (cathode-ray-tube). The magnetic media may take the form of card, tape, fixed disk, or floppy disk (diskette). The printer unit is the same as the keyboard unit in the thin window equipment but is a separate unit on equipment with CRTs.

  - Shared-Logic Word Processor -- Aids user in preparation of original typing and extensive text editing. Many have records/list processing capabilities. Some are user programmable and are capable of performing EDP-similar applications that can be integrated with word processing. Includes terminals, central processor (and/or controller), printers, and other peripherals. Each terminal usually shares the word processing power, storage, and peripherals of the central computer. Sometimes included in this category are distributed logic systems which may share peripherals and often share storage, but have most computer power (logic) distributed at the individual operator stations.

  - Minicomputer -- Aids user with the same kinds of capabilities as a large computer, but on a limited scale. Many have word processing packages and data processing programs that can be integrated. Sometimes

a distributed logic system is composed of multiple minicomputers at the points of need which connect to a large centralized data processor. Terminals may be intelligent or dumb.

- Data Processing System -- Aids user with the execution of a programmed sequence of operations upon data. Usually supports many applications, e.g., payroll, inventory, word processing, etc.

The output phase encompasses the generation of an electronic, optical, or hard copy document. The output phase may be difficult to distinquish from the production phase. A distinquishing feature is the intended use of the output document. If the document is subject to further manipulation or processing, production is still in process. If it is to be distributed, production is complete. Representative equipment includes:

- Word Processing Impact Printer -- Types in final copy quality at low speeds. Capable of producing carbon copies during printing. It is usually physically hardwired to the word processor.

- Word Processing Non-Impact Printer-- Produces draft-and/or final-copy quality at relatively high speed. Usually, incapable of producing carbon copies; however, it prints multiple copies of a document on request. It may be physically hardwired to the word processor or a stand-alone unit which receives print requests and data via magnetic media and/or communication lines.

- Data Processing Printer -- Produces nonquality copy at high speed. It may be a serial (matrix) or line printer. Output is usually all upper case; however, upper and lower case capability is sometimes available. It may be physically hardwired to the computer or receive data via communication lines.

- Photocomposer -- Prepares finished, typesetter-quality copy which is ready for printing. Text usually has justified lines. Conserves space by packing more text on a page. Uses enhanced internal logic to generate

characters via a CRT display tube. Some may be connected to certain word processors. Font styles and sizes are determined under program contol with no external film font masters.

- Micrographics -- Reduces document storage space requirements. Used alone or in conjunction with a computer. Microform types include roll, jackets, fiche, and aperture cards. Microform location determination can be accomplished by coding the film as documents are photographed. Retrieval devices range from mechanical reader-printers to automated terminals. Computer output microfilm (COM) and computer generated graphics are included in this group.

. The distribution phase involves the transmission or movement of output documents or data. Representative equipment includes:

- Intelligent Copier -- Directly converts electronically stored data or text (prepared by a computer or word processor) into multiple, hard copy output. Print requests and information are usually received via hardwired attachment or communication lines; however, some also have the capability of reading and/or writing magnetic media. Some adjust printing to alternative formats. Other available options include collating and multi-side copying.

- Facsimile (FAX) -- Relays alphanumeric and graphic information to remote sites through ordinary telephone lines, private transmission lines, or microwave relay systems.

- Executive Telephone -- Aids the professional in daily communications and personal computing needs. Features may include call pickup, automatic dialing, LCD display, calculating, clocking, and appointments calendaring.

- Word Processing/Data Processing System with Communication Feature -- Sends and receives alphanumeric information stored on the system. Usually includes ability to store, retrieve, and forward information. Transmission occurs via hardwired attachments and/or communication lines. Some systems support communicating intelligent terminals. If primary use is person-to-person communication, it can be considered a form of electronic mail.

These sample productivity improvement citings have been derived from representative sources available as of March 1, 1980. New technological developments are rapidly changing the productivity to be derived from the use of these representative equipment types. Therefore, the information needs to be continuously researched and updated. To facilitate this effort, a Bibliography of Sources of Office Automation Information is included in this appendix.

INPUT PHASE

Equipment	Benefits	Drawbacks	Citing
Dictation	• Input is four times faster than longhand • Transcription is twice as fast as reading longhand or shorthand • Any secretary can transcribe • Priority work can be handled • 24-hour input is allowed	• Clarity of thought and expression is required • Pre-organization of material by dictator is necessary • Many originators resist dictation	• 6.25% - 12% time savings/day- Herbert M. Kaplan, Words, International Word Processing Association, June - July 1980, pp. 40-43
Electronic Typewriter with OCR Font	• Correction time is reduced • Input via OCR reader into production equipment is possible	• No text editing is possible • No storage capacity is available • Input into production equipment is off-line	• See Optical Character Recognition citing

INPUT PHASE (continued)

Equipment	Benefits	Drawbacks	Citings
Optical Character Recognition	• Every typewriter with an OCR font can be a low level input device for text editing and data manipulation • Re-keyboarding of input text/data is eliminated • Production equipment is freed for word or data processing • Work distribution is enhanced	• Generally only a limited number of fonts can be read • Scanning errors are possible • Specific input formats may be required • Accuracy depends upon ribbon, strike, paper, and other variables	• 600% increase in throughput, Compuscan sales literature, AW-5B-018.0
Personal (Professional) Terminal	• Data entry, access, and retrieval time can be reduced • Paper and supplies can be saved through electronic capture of keystrokes • Can be expanded, reconfigured, or networked as applications expand and new requirements evolve	• Training is required • CPU downtime can affect the use of the terminal • Response degradation may occur during peak periods	• 50% productivity rise- Emerick G Zouks, Business Week, April 7, 1980, pp. 81-82.

PRODUCTION PHASE

Equipment	Benefits	Drawbacks	Citings
Blind Automatic Word Processor	• Correction time is reduced • Light-change text editing is handled	• Text editing functions are limited • Large amounts of text cannot be manipulated • Storage may be limited	• Average 48%-69% productivity improvement if used for original and revision typing; average 69%-98% if used for revision only; NARS standards
Stand-alone Display Text Editors	• Extensive text editing is easily handled • Input and formatting is facilitated by a CRT • Saves paper and supplies through electronic capture of keystrokes	• Some are unprogrammable • Large data bases may not be manipulated • Storage may be limited	• Average 75%-133% productivity improvement if used for original and revision typing; average 104%-181% if used for revision only; NARS standards
Shared Logic Word Processor	• Extensive text editing is easily handled • Input and formatting is facilitated by a CRT • Saves paper and supplies through electronic capture of keystrokes • Different tasks may be performed at the same time • Some are programmable by the user	• CPU downtime can be a problem • Specially trained personnel may be necessary to administer the system • Response degradation may occur during peak periods • System back-up may be limited	• Average 84%-89% productivity improvement if used for original and revision typing; average 115%-122% if used for revision only; NARS standards

PRODUCTION PHASE (continued)

Equipment	Benefits	Drawbacks	Citing
Minicomputer	• Can be expanded, reconfigured, or networked as applications expand amd new requirements evolve • Performs many different tasks at the same time • Can support simultaneous users • Is programmable • Paper and supplies can be saved through electronic capture of keystrokes	• Early obsolescence on large investment is a risk • System backup may be limited • CPU downtime can be a problem • Response degradation may occur during peak periods	• Same statistics as for shared logic word processors • Data processing figure totally dependent on each application
Data Processing System	• Handles many applications • Is programmable • Can be expanded, reconfigured, or networked as applications expand and new requirements evolve • Performs many different tasks at the same time • Can support a large number of users • Handles large amounts of text or data	• CPU downtime can be a problem • Specially trained personnel may be necessary to administer the system • May be susceptible to response degradation during peak periods • System backup may be limited • Techniques and procedures usually are alien to the office environment	• Same statistics as for shared logic word processors • Data processing figure totally dependent on each application

OUTPUT PHASE

Equipment	Benefits	Drawbacks	Citing
Word Processing Impact Printer	• High quality print is produced • Carbon copies can be created • Automatic single sheet feeder or continuous form paper may be used	• Changing printwheels can be time-consurimg • Inserting paper may be required	• 15 to 55 characters per second burst speed, Datapro Reports on Word Processing, April 1980 148-533% faster than electric typewriter capability
Word Processing Non-Impact Printer	• High quality print is produced • Automatically feeds paper • Typestyles are changed electronically within the printer	• Usually prints no carbon copies	• 77 to 92 characters per second burst speed, Datapro reports on Word Processing, April 1980 770-918% faster than electric typewriter capability
Data Processing Printer	• Prints at high speeds • Carbon copies can be created • Usually incorporates an automatic paper feed	• Print quality is usually unacceptable for word processing output	• 40-120 characters per second (matrix), Auerbach Computer Technology Reports #31, 1978, p. 13 1,184-3,554% faster than electric typewriter capability

OUTPUT PHASE (continued)

Equipment	Benefits	Drawbacks	Citing
Data Processing Printer (continued)			• 150-2,000 lines per minute (line), Auerbach Computer Technology Reports #31, 1978, p. 13 4,813-6,417% faster than electric typewriter capability
Photocomposers	• Word processors may serve as a means of keyboarding for preparing photocomposer input • User can save between 30-40% in the final required number of pages • OCRs may be used to generate photocomposer tapes • Document preparation time may be decreased	• May be less expensive to procure this service from outside vendors • Compatibility with other systems may be a problem	• 20-80 lines per minute, Datapro Reports on Office Systems, September 1979 641-2,566% than electric typewriter capability

OUTPUT PHASE (continued)

Equipment	Benefits	Drawbacks	Citing
Micrographics	• Recording on microfilm consumes as little as 2% of the space occupied by the same records on paper • Only seconds are involved in retrieving one of a million records filed within reach of a seated operator • Duplicate microfilm files kept off premises to protect against loss of vital information • Magnetic-tape data are made readable on microfilm in a fraction of the time required for printing out on paper • Microfilm records retention cost is considerably lower than paper records systems	• Archive quality of film images is questionable • Quality control and inspection procedures must be maintained during the filming, processing, and storage activities Complexities exist when indexing for automated retrieval • High costs may be associated with conversion of existing paper files to microform images	• 25% (Comander Lloyd C. Burger)- 62% (Reuben Donnelly) access/retrieval time savings, Modern Office Procedures, May 1977, p. 60

DISTRIBUTION PHASE

Equipment	Benefits	Drawbacks	Citing
Intelligent Copiers	• Document storage can be reduced • Speed of document communications can be enhanced • Scope of document communications can be enhanced • Acts as a convenience copier	• Copier may be used as a printing press with increased per page costs • Potential exists for excess copying • Potential exists for non-business copying	• 75-600 characters/second transmission speed, IBM 6670 literature (G54 1006) When 600 cps com to 2 days for mail to arrive, 3927 times faster for page with 50 lines (65 characters/line)
Facsimile (FAX)	• Electronically sends text, graphic data, photographs, drawings or charts with little difficulty • Documents transfer much faster than mail, messenger, etc.	• Line costs are relatively high • Compatibility with receiving device must exist • Sizes of sending and receiving documents are limited • Certain devices require station-to-station coordination • Quality of received documents may not be acceptable	• 30 sec- 6 min. to transmit 8 1/2 X 11 page, Datapro Reports on Office Systems #2, June 1980 When 6 min. compared to 2 days for mail to arrive, 480 times faster
Executive Telephones	• Reduces staff time in using the telephone • Provides arithmetic capabilities	• Difficult to cost justify	• No citing available

DISTRIBUTION PHASE (continued)

Equipment	Benefits	Drawbacks	Citing
Word Processing Data Processing System with Communications Feature	• Increased speed of document or data communications	• Possible compatibility problems with mainframe or minicomputer	• 40% reduction in dissemination time, Report on Electronic Mail, 4th Quarter 1978, Yankee Group, p. 13

Bibilography of Sources of Office Automation Information

Reference Materials*

Annual Review of Information Science and Technology
American Society for Information Science
1010 Sixteenth Street, N. W.
Washington, D. C. 20036

Datapro Reports on Office Systems
Datapro Reports on Word Processing
DataPro Research Corporation
1805 Underwood Boulevard
Delran, New Jersey 08075

Auerbach Computer Technology Reports
Auerbach Publishers, Inc.
6560 North Park Drive
Pennsauken, New Jersey 08109

Quarterly Bibliography of Computers & DP
Applied Computer Research
P.O. Box 9280
Phoenix, Arizona 85068

Selection of Terminals
Association for Systems Management
24587 Bagley Road
Cleveland, Ohio 44138

*Note: Vendor literature also provides information.

Professional Associations

Administrative Management Society
2360 Maryland Road
Willow Grove, Pennsylvania 19090

American Society for Information Science (ASIS)
1010 Sixteenth Street, N. W.
Washington, D. C. 20036

Association for Systems Management
24587 Bagley Road
Cleveland, Ohio 44138

Association of Records Managers and Administrators
P.O. Box 281
Bradford, Rhode Island 02808

International Word Processing Association (IWPA)
Maryland Road
Willow Grove, Pennsylvania 19090

National Micrographics Association
8709 Colesville Road
Silver Spring, Maryland 20910

Society for Management Information Systems
One Illinois Center
Suite 600
111 East Wacker Drive
Chicago, Illinois 60601

Periodicals

Administrative Management
Geyer-McAllister Publishers
51 Madison Avenue
New York, New York 10010

ARMA Records Management Quarterly
Association of Records Management and Administrators
P.O. Box 281
Bradford, Rhode Island 02808

Business Communications Review
36 South Washington Street
Hinsdale, Illinois 60521

Business Week (Information Processing Section)
McGraw-Hill,Inc.
1221 Avenue of the Americas
New York, New York 10020

Communications News
Harcourt, Brace, Jovanovich, Inc.
402 West Liberty Drive
Wheaton, Illinois 60137

Computer Business News
C.W. Communications, Inc.
797 Washington Street
Newton, Massachusetts 02160

Computer Decisions
Hayden Publishing Company, Inc.
50 Essex Street
Rochelle Park, New Jersey 07662

Computer Graphics & Image Processing
Academic Press, Inc.
111 Fifth Avenue
New York, New York 10003

Computers and People
Berkeley Enterprises, Inc.
815 Washington Street
Newtonville, Massachusetts 02160

Computerworld
Computerworld, Inc.
797 Washington Street
Newton, Massachusetts 02160

Corporate Systems
United Technical Publications, Inc.
645 Stewart Avenue
Garden City, New York 11530

Datacomm User
Communications Trends, Inc.
214 Third Avenue
Waltham, Massachusetts 02154

Data Management
Data Processing Management Association
505 Busse Highway
Park Ridge, Illinois 60068

Datamation
Technical Publishing Company
1801 South La Cienega Boulevard
Los Angeles, California 90035

Distributed Processing Digest
Marketeers, Inc.
10522 Ridgeway Drive
Santa Ana, California 92705

Dun's Review
Technical Publishing Corporation
666 Fifth Avenue,
New York, New York 10019

EDP Analyzer
Canning Publications, Inc.
925 Anza Avenue
Vista, California 92083

EDP Industry Report
International Data Corporation
214 Third Avenue
Waltham, Massachusetts 02154

EDP Weekly
EDP News Services, Inc.
7620 Little River Turnpike
Annandale, Virginia 22003

EFTS Industry Report
EDP News Services, Inc.
7620 Little River Turnpike
Annandale, Virginia 22003

Periodicals (continued)

Electronic News
Fairchild Publications, Inc.
7 East 12th Street
New York, New York 10003

Forbes
Forbes, Inc.
60 Fifth Avenue
New York, New York 10011

Government Executive
Executive Publications, Inc.
1725 K Street, N.W.
Washington, D.C. 20006

IBM Systems Journal
IBM Corporation
Armonk, New York 10504

IEEE Spectrum
Institute of Electrical and Electronics Engineers, Inc.
445 Hoes Lane
Piscataway, New Jersey 08854

IMC Journal
Information & Records Management, Inc.
250 Fulton Avenue
Hempstead, New York 11550

Industrial Engineering
American Institute of Industrial Engineers, Inc.
25 Technology Park/Atlanta
Norcross, Georgia 30092

Industry Week
Penton-IPC
Penton Plaza
Cleveland, Ohio 44114

Information & Records Management
Information & Records Management, Inc.
250 Fulton Avenue
Hempstead, New York 11550

Information Systems
Pergamon Press, Inc.
Maxwell House
Fairview Park
Elmsford, New York 10523

Information World
Indian Head, Inc.
1022 Wilson Boulevard
No. 1401
Arlington, Virginia 22209

Infosystems
Hitchcock Publishing Company
Hitchcock Building
Wheaton, Illinois 60187

Interface
U.S. National Institutes of Health
Division of Computer Research & Technology
Computer Center
Building 12, Room 2244
Bethesda, Maryland 220014

International Management
McGraw-Hill, Inc.
1221 Avenue of the Americas
New York, New York 10020

Journal of Micrographics
National Micrographics Association
8728 Colesville Road
Silver Spring, Maryland 20910

Journal of Systems Management
Association of Systems Management
24587 Bagley Road
Cleveland, Ohio 44138

Management Review
American Management Association
135 West 50th Street
New York, New York 10020

Management World
Administrative Management Society
Maryland Road
Willow Grove, Pennsylvania 19090

Micrographics Newsletter
Microfilm Publishing, Inc.
Box 313
Wykagyl Station
New Rochelle, New York 10804

Mini-Micro Computer Report
EDP News Services, Inc.
7620 Little River Turnpike
Annandale, Virginia 22003

Mini-Micro Systems
Cahners Publishing Company
Division of Reed Holdings, Inc.
270 St. Paul Street
Denver, Colorado 80206

Modern Office & Data Management
Rydge Publications Pty. Ltd.
Box 3337
Sydney, N.S.W. 2001
Australia

Modern Office Procedures
Penton-IPC
614 Superior Avenue, West
Cleveland, Ohio 44113

Nation's Business
Chamber of Commerce of the United States
1615 H Street, N.W.
Washington, D.C. 20062

OFFICE

Office Publications, Inc.
1200 Summer Street
Stanford, Connecticut 06904

Officemation Reports
Management Information Corporation
140 Barclay Center
Cherry Hill, New Jersey 08034

Small Systems World
Hunter Publishing Company
53 West Jackson Boulevard
Chicago, Illinois 60604

Technology Review
Massachusettes Institute of Technology
Alumni Association
Cambridge, Massachusetts 02139

Telecommunications
Horizon House
610 Washington Stsreet
Dedham, Massachusetts 02026

Telephony
Telephony Publishing Corporation
55 East Jackson Boulevard
Chicago, Illinois 60604

Word Processing Report
Geyer-McAllister Publishers
51 Madison Avenue
New York, New York 10010

Word Processing World
Geyer-McAllister Publishers
51 Madison Avenue
New York, New York 10010

Words
International Word Processing Association
Maryland Road
Willow Grove, Pennsylvania 19090

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☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

11. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)

Office automation systems can be broadly defined as those that transform ideas into written communications via the interaction of people, procedures, and equipment. In recent years, numerous studies, reports, and articles have proposed that the use of such systems will contribute to the efficient preparation and distribution of general office communications and work products. However, the Federal experience with office automation has been primarily limited, thus far, to the implementation of word processing equipment and documented evidence of the benefits received from these installations have not been produced.

This guideline presents a methodology for determining the feasibility and practicality of introducing (or expanding) office automation systems within the Federal Government. It is applicable to all office automation technologies such as word processors, dictation equipment, and telecommunications and is designed for use by agency officials and other employees who have the responsibility for productivity improvement, procedural analysis data processing, or office systems.

12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)

Computer based office systems; office automation; requirements analysis.

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